ENGINEERING NEWS

IN the contractors' claim for extra excavation on the New Croton Aqueduct, Corporation Counsel BEEKMAN, on Aug. 6, gave an opinion in favor of the city of New York. He advised the Comptroller that the adoption of a resolution by the Aqueduct Board defining its opinion of the legal tunnel cross-section, did not impose, of itself, any legal liability upon the city, to pay for tunnel excavation outside of the normal lines. He says

"That in no event shall the City of New York be held in any action or proceeding brought or had, under any contract so made, to any other or greater liability than that expressed therein, nor required to pay out or otherwise dispose of any sum of money for the doing of such work or the furnishing of such material greater than is stipulated in such contract or otherwise than in strict conformity to the terms thereof.

"The necessary predetermined space for the aqueduct which had been planned with such additional spaces which might be ordered by the engineer, necessary to meet exigencies which could not be defined in advance, except as generally indicated in paragraphs 22 and 23 of the specifications (which refer to additional excavation ordered by the engineer) constitute in my opinion the measure of allowable excavation to the contractor.

"In the absence of any other location of the line denoting the limit of allowance for tunnel excavation which may be established by the engineer, in pursuance of such power in that regard as he may possess under the contract, the line of the cross-section described upon the sheets of the plans as A A A must control.

"A thorough inquiry should be immediately made in this direction for the purpose of obtaining in connected forms the facts necessary to a correct determination of the extent of the city's liability. This opinion is not to be extended in its application to sections other than those denoted as sections Nos. 2, 3, 4, 5, 6, 7, 8 and 9."

GENERAL Manager M. S. BELKNAP of the Central, Railroad of Georgia, has sent out a party of men selected from the service of the company to make a tour of some of the principal lines of railway, visit railway centers in the South and East and see what other companies are using in new devices and new methods, which the Central could profitably adopt. The party is to take several weeks for the trip and will visit Louisville, Cincinnati, Pittsburg, Philadelphia, New York, Roanoke, Richmond and Norfolk. Its members are E. E. ANDERSON, train master, South Carolina division; F. H. MCGEE, assistant general master mechanic; M. MARTIN superintendent southwestern division; G. D. SMITH conductor, and W. H. LATHROP, engineer Southwestern division; James STEVENS, superintendent; G. D. ELDRIDGE, civil engineer; W. D. STAUBB, assistant master-mechanic, South Carolina division; F. D. ARDEN, engineer.

THE cable war has been ended by the signing of a new schedule of rates, to take effect September 1. and hold for one year. The rate decided upon for cabling from New York, Brooklyn, and the New England States, Quebec and Ontario, to England, France and Germany is 25 cts. per word for general messages, and 10 cts. per word for press dispatches. The former rates were 12 and 6 cts. respectively. A joint schedule of land rates, in connection with the cable, was also agreed upon, the charge ranging from 3 cts. per word for New York State, New Jersey, Pennsylvania, Maryland, Delaware and the District of Columbia, to 17 cts. per word for British Columbia. It is stated that the agreement deals only with the rate,and that no pool has been entered into.

THE amendment to the Sundry Civil bill appropriating $200,000 to investigate the project advocated by Major POWELL, of constructing storage reservoir in the canons of the Rocky Mountains, was passed by the Senate, July 30, by a majority of eleven. The amendment was proposed by Senator BOWEN, who made a very able speech in favor of the measure which was followed by a prolonged discussion showing the general interest felt in the scheme.

THE dimensions of the Harlem river street tunnel, the recommendation of which by the Special Commission was noted in our issue of Ang. 4, are the following: length between bulkheads, 450 ft.; approaches, each 1,800 ft. long with gradients of .03; the tunnel to be divided into three sections, two for driveways, and one smaller and higher up, for a footway; the driveways to be 18 to 20 ft. wide by 15 ft. high; the footway 15 ft. wide and 10 ft. high. The tunnel, the southern approach, and most of the northern approach will have to be cut through solid rock, which will make it substantial, but increases the cost to about $2,000,000.

ACCORDING to report, the Pittsburg Steel Casting Co. recently cast a steel shell, the first ever made in this way; they are said to have received an order for 500 for experimental purposes, to be followed by a further order for 2,000. Steel shells have been made in England, but they were cut from a forged ingot and then bored. The shell cast is conical, 6 ins. maximum diameter and 2¾ ins. minimum diameter. The length is 21¼ ins.; the weight of metal, 95 lbs., making, with the charge of 5 lbs. of powder, a total weight of 100 lbs.

THE vivid imagination of a reporter of a Buffalo paper transforms a water-car actually used by the Lehigh Valley R. R. Co., for sprinkling newly laid cinder-ballast, into a device to be attached to the front of passenger trains for the greater comfort of travelers. This "news note" is akin to another in a late leading New York daily, stating, on the authority of a prominent member of the recent Telegraph Superintendents' Convention, that the astonishing increase in railway trains in the West had led to a corresponding increase in the number of telegraph wires—"as a separate wire was required for each train."

THE most serious railway accident of the week was the derailment, Aug. 8, of a passenger train near Germantown, Ind., on a branch of the Cincinnati, Indianapolis, St. Louis & Chicago Railroad. The cause was a broken rail. The baggage car and one passenger car went down a 25-ft. bank. About 25 persons were injured, but only one fatally.——A broken rail also derailed several cars of a fast passenger train on the Atchison, Topeka & Santa Fé Railroad, near Lawrence, Kan., Aug. 6. One man was killed and several injured.——A Baltimore & Ohio engine went into the open draw of the Schuylkill river bridge below Gray's Ferry, at Philadelphia, Pa., Aug. 8. The bridge tender says the proper signals were out, but a man who was riding on the tender says no signals were visible. One man was killed and two injured.

DURING the week there have been heavy electrical storms in several parts of the country, causing considerable damage; much telegraph plant and apparatus was injured. Washouts have occurred on the Taylor's Falls branch of the St. Paul & Duluth; the Fergus Falls branch of the St. Paul, Minneapolis & Manitoba road, the Northern Pacific, the Union Pacific, and the Atlantic & Pacific. At the last a freight train was wrecked.——A dam at Goff's Falls, N. H., has been washed out.——A tornado did much damage at Springfield, O., Aug. 7.

THE following bridge accidents are reported: On Aug. 1, a freight train on the New York, Chicago & St. Louis, went through a trestle near Silver Creek, N. Y. One man was injured.——On Aug. 2, a span of the Baltimore & Ohio bridge over the Youghiogheny, near Connellsville, Pa., gave way, precipitating a shifting engine and one car into the river. The accident is reported to have been caused by rotten timbers. The bridge was little used, but according to newspaper accounts the unsafe condition of the bridge was well known to trainmen. "The moral of it is that bridge inspectors cannot be too careful or bridge repairs too constant or thorough."——On Aug. 4, the stringers of a toll bridge across the St. Croix river at Calais, Me., gave way under a team, throwing the team and two men into the river.

A SERIOUS railway accident occurred at Hampton Wick., near London, England, on Aug. 6. A train of empty freight cars was, by a blunder of a signal man, turned onto the wrong track and ran into an excursion train which was running at full speed. Both trains were wrecked. Six persons were killed and about 25 injured; some of them fatally.

ON Aug. 6, according to a dispatch to the New York *Times*, the London & Northwestern railway ran a train from London to Edinboro, 400 miles, in 7 hours and 25 minutes, excluding stops. This is at the rate of 53.89 miles per hour, the fastest time for the length of run on record in England. The previous best record was from Liverpool to London, 200 miles, in 3 hours and 59 minutes; or, slightly over 57 miles per hour. During the run speeds of 72 and 75 miles per hour for 8 or 10 miles were attained; one run of 158 miles, in 2 hours, 58 minutes, was made without a halt; from Warrington to Wigan the run of 51 miles was made in 51 minutes; 104 miles in 106 minutes, from Carlisle to Edinboro, was the crowning feat. The opposition train of the Great Northern Railway left London at the same time; but the "Flying Scotchman" was beaten 7 minutes in time and 8 miles in distance.

IT is reported that a deposit of pure asphalt has been discovered near Grayson Springs, Ky. Considerable bituminous sandstone exists in Kentucky, but heretotore none has been found of any commercial value, yielding only 6 or 7 per cent. of bitumen. The only asphalt mines existing in this country now, are in California, where a bituminous sandstone is found, yielding about 25 per cent. of bitumen, and is used for street paving.

A SELF PROPELLING, floating steam fire engine has recently been completed by an English firm and shipped to the port of Buenos Ayres. It is 60 ft. long and 11 ft. beam, is propelled by two steam engines, working directly on the screw shaft, and is capable of running at the rate of more than 11 miles per hour. The steam fire engine is capable of delivering 1,450 galls. of water per minute, and the boiler, is said to raise steam to full working pressure from cold water in about 8 minutes.

THE Municipal Council of Paris is reported to have voted $200,000 to erect an electric light station in the Halles Centrale to supply the whole city, but it is doubtful if the Government will permit such a monopoly to exist.

IT is reported that the cable for the mouth of the Columbia river, for which an appropriation of $5,000 was made in the urgent deficiency bill of the present session, arrived at Astoria, Ore., Aug. 5, and that an officer has has been ordered to Astoria to inspect and superintend its laying It is expected that the cable will be in satisfactory working condition by the middle of August.

A REPORT which has been in circulation that the Lake Shore & Michigan Southern Railway was replacing plank platforms at stations along its line with concrete, proves to have only the foundation that the company, at some points where plank platforms require renewal, is putting in a gravel or cinder walk in their place.

A NOVEL safety ship brake, for preventing collisions at sea, is to be tested, according to report, on a ship of the French navy this month. The ship to be used has engines of 2,500 horse-power, and is capable of developing 19 knots per hour. The accounts of the PAGAN brake are vague: but the principle seems to be the throwing out of fans from the sides, as the effect is described as being similar to that produced by a parachute.

RUSSIA evidently means to develop Siberia, and it is reported will complete the preliminary surveys for the 961 miles of railway between Tomsk and Irkoutsk during the present year. Included in the scheme is an iron bridge about 3200 ft. long, over the Yenesei river. The surveys for the Central Siberian Railway are also being rapidly pushed, six different parties of engineers being at work.

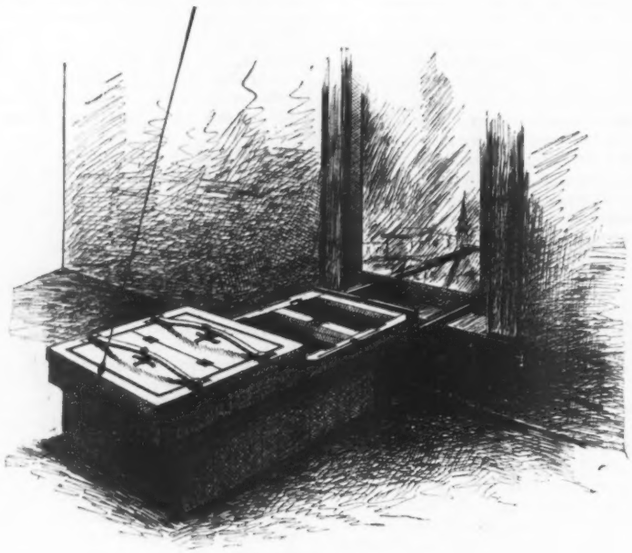
THE difficulty usually said to obtain in putting in long plate girders is much over-estimated. On Aug. 5 a plate girder bridge (deck) was carried ⅛ mile and dropped in place without any difficulty, and with such tools as all railroads possess. The span of bridge equals 103 ft. This bridge was located on the line of the N. Y. Central R. R.

A PAPER entitled "*Mechanical Pathology Considered in its Relation to Bridge Design*" by G. H. THOMSON, Bridge Engineer, N. Y. Cen. & H. R. R. R., will be read before Section "G" of the British Association for the Advancement of Science, at its next meeting in Sept., by Mr. BENJ. BAKER, Engineer of the Forth Bridge.

THE German imperial commission of the North Baltic canal is advertising for proposals for the further excavation of the earthwork for this canal, which starts from Kiel, in Schleswig-Holstein, and runs across the peninsula, connecting the Baltic and the North seas. The total amount of earthwork is about 67,000,000 cu. yds.

Apparatus for Making Blue Prints.

We are indebted to Mr. F. S. INGOLDSBY, Resident Engineer, St. Louis, Arkansas & Texas Railway, for the drawings and description of the blue print frame which we give herewith. This apparatus was designed by Mr. INGOLDSBY for the purpose, as he expresses it, "of ameliorating the troubles of the average blue print artist and to abridge profanity. I say 'average' for the reason that I presume those



Making a Blue Print.

above that grade are already supplied with much more elaborate appliances for handling their heavy frames. Out here in the West, however, I have never seen anything devised for this purpose, and whenever it became necessary for me to make a print I was forced to simply call into play man's original machine—muscular energy."

There are certainly many offices equipped with much more elaborate and expensive appliances for blue printing than this one, but it is equally certain that there is a much larger number where a simple and efficient device of this kind is a much needed improvement. The illustrations are sufficiently clear and full to need no explanation other than the following comments by Mr. INGOLDSBY.

The loose pin butts shown answer their purpose well, but a more perfect hinge, and one doing away with the necessity of pulling out and putting in pins, and hence one time-losing item less, would be a ball and socket casting. A balance weight attached to a rope run through pulleys fastened to the ceiling aids materially in turning the frame over or lifting it into position.

The wheels for the carriage need be nothing more expensive than ordinary sash pulleys, and the track is cheaply made by ploughing a ¼ inch groove 1 in. deep, in two pieces of 3x3 in. pine of desired length, and fitting into the same a piece of 1½x1¼ in. strap iron. The space inside the room and underneath the track can be boarded up and utilized for storing transits, paper, or other material. There are rubber bumpers made of an ordinary Davidson eraser sunk into the frame. Any carpenter can "knock it together" in two or three days, and its cost, even in places where wages are high, should not exceed $15 or $20.

Having had one made and in operation in this office for some time, we find that it is a great saving in time and labor, and reduces to a minimum the chances of that well-known disaster—a broken glass. We have made as high as nine large prints in twenty-six minutes, with exposures of from one and one-half to two minutes for each print.

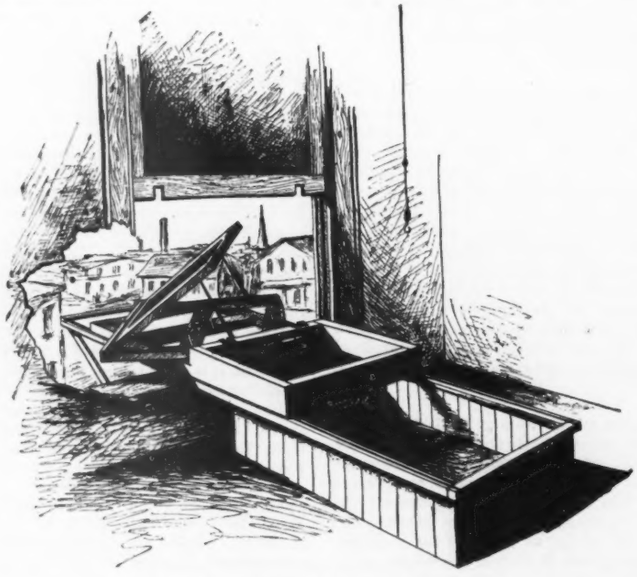
THE London *Railway News* is responsible for the statement that English capitalists are interesting themselves in the Hudson River Tunnel. Our contemporary says that $900,000 will complete one of the two tunnels commenced. Sir JOHN FOWLER and Mr. BENJAMIN BAKER are named as the consulting engineers, and English engineers are to control the whole work. An issue of $1,500,000 five per cent. bonds is to be placed in England and $1,000,000 in the United States; and the Bank of Scotland is named as the party issuing the bonds. The directors are well equipped with personal titles, as is usual in such cases provided in England.

Notes on the Water Meter System of Providence, R. I.—From 1872 to 1887 Inclusive.*

BY EDMUND B. WESTON,
Member of the Boston Society of Civil Engineers.

I have arranged my subject into the following six divisions, in such a manner as will best answer, in a general way, the most important questions that are frequently asked relative to the water meter system of Providence:

1. The consumption of water in Providence; the force who read and repair the meters; and general notes and conclusions.
2. Method of testing meters.
3. Manner of setting meters.
4. Different kinds of meters in use.
5. Expense of maintaining meters.



Frame Turned Over for Removing Print.

6. Nature of the work charged to the meter maintenance account.

CONSUMPTION OF WATER, ETC., ETC.

During the year 1887 the daily average consumption of water of the city of Providence, and consumers on 15 miles of distribution pipe outside of the city limits, as well as the State institutions in Cranston, was 4,940,000 gallons. This is equivalent to 39 gallons per capita, considering the total population of the city, and the number of consumers supplied in the suburbs.

The average daily consumption per tap has been during the last six years, viz.: 1882, 354 gallons; 1883, 379 gallons; 1884, 356 gallons; 1885, 395 gallons; 1886, 384 gallons; and 1887, 376 gallons.

Fifty-eight per cent. of the water services in Providence had meters on them on December 31, 1887.

Experience has led me to the conclusion that the use of meters prevents an extravagant use of water, while at the same time it does not prevent the quantity being used which is essential for good health and necessary domestic purposes; as the consumers who pay for the actual quantity of water that they use are much more liable to see that their plumbing and fixtures are kept in good condition, than are those who pay at fixture rates.

I will mention one of the many cases that my attention has been called to, in substantiation of this conclusion, as an illustration. Several years ago, a bill of $117 for one year's consumption of water was presented to a citizen of Providence, and as his bills had not averaged more than $17 previous to that time, he naturally questioned it, and intimated that his meter must be wrong, as he was positive that he had not used anywhere near the amount of water that was specified in the bill. The meter was disconnected and tested, and found to register correctly; he then had a plumber examine his piping, who reported that it was in good order. The final result was that the Water Board sent two of their own employés to make an investigation, who after spending considerable time discovered a hole in a ¾-inch lead pipe that was laid under a green-house floor, through which a large quantity of water was flowing, that at once accounted for the unusually large use. Now, in all probability, if this supply had not been metered, as to all outward appearances the plumbing about the premises was in the best condition, this large waste of water might have gone on for years.

If meters had not been used in Providence, there is not any doubt but that the consumption of water since 1871, the time when the Pawtuxet water was first introduced into the city, would have been much larger than it has been; consequently considerable expense has been saved, with regard to fuel, wear and tear of pumping machinery, and possibly a large outlay for additional pumping plant, etc., that might have been required.

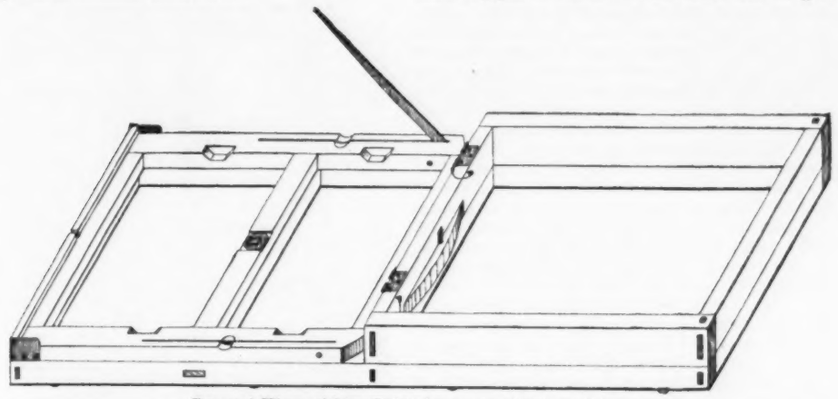
The minimum water-rate in Providence, when meters are set, is $10 per annum. At the present time (December 31, 1887), about thirty-seven per cent. of the consumers who take their supply through meters pay the minimum rate.

It is generally considered advantageous to consumers, whose bills at the usual fixture rates would exceed $14 or $15 per annum, to have meters set, the $4 or $5 above the minimum amount being allowed for interest on the outlay, and the maintenance of the meters.

*From the *Journal of the Assoc. of Engineering Societies*, Aug., 1888.

The meter system in Providence seems to give satisfaction, both to the city and the consumers who have meters. The meters are the property of the consumers, who are obliged to purchase such as are approved by the Water Department, whose employés set them and make all necessary repairs, etc., at the consumer's expense. It is optional with the consumers whether they will have their services metered or not; but the Water Board reserve the right to set meters, at their own expense, whenever they deem it advisable; this is rarely done, however, except in cases where there seems to be a large or extravagant use of water.

The Water Board permanently employs three men who read all the meters quarterly, which takes on the average about five weeks during each quarter; and to do all the necessary water fixture inspection that is required, as well as other work connected with meters, etc., in the office. Probably, if meters were not used, more than three inspectors would be equired to examine fixtures, etc.



General View of Blue Print Apparatus Without Glass or Frame.

[NOTE.—Titles to cuts on opposite page should be transposed. Error was not discovered till the page had gone to press.]

When meters get out of order, or fail to register altogether, and the consumers have not previously notified the Water Department of the fact, it is easily detected by these men every quarter, by being obvious at the time the meters are read, or by comparing the amounts registered with the amounts registered during previous quarters, which is always done if there is the slightest question of doubt as to the registration of the meters; consequently the city sustains very little loss, if any, when meters are found to be out of order at the end of a quarter, as the amount for the quarter is estimated from previous quarterly readings. Meters very rarely fail to register during the first quarter that they are in service, but when they do, as the water bills are payable yearly, with the exception of those of the large consumers, which are collected quarterly, there is generally very little difficulty in estimating the quarterly deficiency.

There is a shop connected with the Water Department, which is fitted up expressly for repairing, testing and storing meters, etc. Three men, the total sum of whose salaries is $2,900 per annum, set on the average 490 new meters per year, in addition to making the repairs on all the meters, the average number of which is about 600 per year, as well as disconnecting and resetting them (the original castings, etc., being obtained from the manufacturers). These men also examine all the elevator counters, open and close such service stops as may be required to be attended to when the service pipe clerk is not within call, make out the returns of work done, keep the detail meter repair accounts, and perform other miscellaneous work that may arise.

I have been informed that the only trial it was deemed necessary under the circumstances to give the first meters that were set in Providence was an ordinary tank test, as the Water Commissioners wished to set meters as soon as possible after water was first introduced into the city. The inadequacy of a test of this kind, I think, will be demonstrated by the facts that will be presented as I proceed. It should be remembered, however, that meters which have iron bodies or parts that water can come in contact with, are placed at a great disadvantage on this account alone in Providence: as corrosive action commences to take effect in a marked degree upon the iron almost immediately after they are set.

Since the year 1877 there have been tested at the Providence Water-Works, under the direction of the City Engineer, more than twenty different kinds of meters at the request of their inventors or manufacturers, in addition to those meters which are now in actual service in Providence. I shall not mention these meters that have been tried and not adopted, however, as it has not been customary in Providence to disclose the results of their tests, other than to their individual inventors or manufacturers.

If the design of a meter is not obviously impracticable at first sight, it is generally very difficult to form a correct opinion as to its merits until after it has been subjected to one or two years' trial (and it cannot always be done then), for the reason that a meter whose principle and mechanism at a preliminary examination may appear to be commendable, will frequently show in actual service defects where and when they are least expected. The water service pipes in Providence are sized according to the requirements of the applicants, who, in each instance, fill out and sign an application, which states for what purpose the water is to be used, and the nature and number of the fixtures on the premises to be supplied. The applicants are allowed to have smaller services than their fixtures call for, provided they make the request in writing upon their applications, as well as larger by paying the additional expense of laying, etc.; but in each instance the meter must be the same size as the service pipe (or at least not smaller). This rule, with regard to meters, may appear to be rather arbitrary at first thought, but it works on the whole very well and saves much debate and controversy.

METHOD OF TESTING METERS IN PROVIDENCE.

Before being accepted by the Water Department, the different kind of meters that are under consideration are subjected to several tests. The first test is for accuracy, on streams varying in diameter from $\frac{1}{16}$ to $\frac{1}{4}$ in., or to the size of the outlet of the meters, the actual amount of water that flows through the meters being weighed.

The second test is for durability, which is accomplished by setting the meter on constant service, in a room prepared for the purpose, in which are laid pipes that lead from the high to the low service, so that a continuous stream of water is obtained without waste, under about 150 ft. head. At different periods during this test, if it is thought best, the meters are disconnected and tested again for accuracy on the streams before mentioned. This test for durability is concluded on ⅝ to 1 in. meters, when from 100,000 to 400,000 cu. ft. of water has passed through each meter. A final test for accuracy is then made, and if the meter registers satisfactorily and an examination shows that they are not badly worn, or have not broken down during the test, they are subjected to the third test, which is made by placing them on regular domestic service; then at the end of six months or a year, they are once more tested for accuracy and once more thoroughly examined, and if the result proves satisfactory they are generally allowed to be set by the Water Department.

After a class of meter has been accepted by the Water Department, each individual meter before being set is tested for accuracy under ordinary pressure on a 1¼-in. stream, and if the error of its registration is not more than 2 per cent., they are allowed to be set. If the error is more than 2 per cent., the meters are returned to the manufacturers. A description of the plant used for testing meters (which was first set up during the year 1878), and the general method of testing is as follows: A 4-in. pipe, etc., brings the water from a 24-in. main to the bench in the meter room where the meters are tested. A short piece of 2-in. flexible pipe is connected to this 4-in. pipe. The meter to be tested is placed upon the bench, and the inlet connected to the flexible pipe by a coupling. To the outlet of the meter another short piece of flexible pipe is also connected in the same manner, which terminates in a 1-in. brass pipe, which is suspended above the bench on a stanchion, and so arranged that it can swing in any direction. A 1-in. faucet is connected to the outlet end of this brass pipe, which is so arranged, that disks, which have holes of different sizes bored in them, can be fastened into it, so that the size of the stream can be enlarged or reduced at will. At a convenient distance from the test bench an iron tank is located upon an accurate pair of scales. This tank is capable of holding about 600 galls.

When the meter is connected, and the proper sized disk has been placed in the faucet, on the brass pipe, it is closed, the water is turned on from the 4-in. pipe, the faucet swung over the tank and opened, and the water allowed to flow until the hand on the 10 ft. dial of the meter registers zero. The faucet is then closed and the water in the tank weighed. The faucet is then again opened, and after 10 cu. ft. of water, as registered on the meter dial, has flowed into the tank, it is once more closed, and the water again weighed, and the difference between the weight of water in the tank when the dial registered at zero, and the weight at 10, is referred to a table, on which is shown opposite to figures corresponding to this difference the percentage of error, if any, in the registration of the meter. The test for accuracy is generally concluded, by running a second stream through the meter while the largest disk is connected (¼ in. for ⅝-in.), and opening and closing the faucet 100 times.

Pressures gauges are connected to the 4-in. and to the 1-in. brass pipes, and the tank has an outlet into a sewer, which can be opened or closed by a valve. The tables for determining the error of registration of the meters are based on a temperature of 70°, but if it is considered necessary, the temperature of the water is taken during the test, and if it is more or less than 70° an allowance is made, the table giving a coefficient for the purpose. A difference of temperature of 10° one way or the other, however, will not generally affect the final result more than one-tenth of 1 per cent.

A new ⅝-in. meter, if properly constructed, ought not to show an error, when subjected to a tank test for the first time, of more than 2 per cent., under 70 lbs. pressure, on streams of $\frac{1}{4}$, $\frac{3}{16}$, $\frac{1}{8}$ and $\frac{1}{16}$ in. in diameter, and not more than 5 per cent. on a $\frac{1}{32}$-in. stream. Under the same pressure it should be able to allow 100,000 cu. ft. or more of water to flow through it, at a rate of at least 1,200 cu. ft. per 24 hours, without showing an increase of error, when again tested for accuracy on the streams before mentioned, from $\frac{1}{16}$ to ¼ in., of more than 2 per cent. It should also be capable, when new, to work under 70 lbs. pressure on ordinary domestic service 4 years, registering at least 50,000 cu. ft., and not show an increase of error at the end of that time of more than 2 per cent. on streams from $\frac{1}{16}$ to ¼ in. inclusive.

A good design of meter on ordinary domestic service ought to run on the average at least 6 years before being repaired, and ought to be serviceable (possibly having to be repaired more or less), for at least 10 years.

MANNER OF SETTING METERS IN PROVIDENCE.

Meters are set when possible in cellars, and as near to the stopcock, which is located just inside of the cellar wall, as possible; thereby allowing for the attachment of lateral pipes beyond the meter. Service pipes generally run into dwellings under their cellar floors; in these cases, a small pit is usually dug in which the meter is set, and packed with mineral wool or plasterers' hair as a precaution against freezing. The walls of these pits are generally built of brick, laid in cement, the natural earth being used for their bottoms, in order

to let any moisture that may get into them leach away. For the smaller sizes of meters, their average dimensions are about 2½ ft. long, 1½ ft. wide, and from 1 to 1½ ft. deep. When the service pipes enter buildings above their cellars floors, the meters are usually located on shelves fastened to the cellar walls, and boxed up, and packed as before mentioned, unless the cellars are sufficiently heated to prevent the meters from freezing. The pits in the majority of cases are built, and the shelves put up by the plumbers at the expense of the proprietors.

It is always deemed advisable to set meters as low as convenient, in order that the water may be drained from them when it is shut off at the stop cocks on cold nights by the proprietors (the stop-cocks each having a waste).

Meters are in some cases, it being impossible to avoid it, set outside of buildings in pits. In these cases the best kinds also have brick walls, the natural earth being used for their bottoms for the reasons before mentioned. In building the walls of these outside pits, a number of bricks are set in each case so as to project into the interior, about half-way between the top and bottom, in order to hold up a horizontal wooden partition that is placed upon them; the space between the partition and the cover, which is at the surface of the ground, and is made of wood or iron, being usually filled with hay to prevent the meter from freezing. The average dimensions for the smaller sizes of meters, are about 3 ft. square and 5 ft. deep. The tops of these pits are arranged so as to prevent surface water from flowing into them. The outside pits, like those of the inside of buildings, are usually constructed by agents of the proprietors at their expense. Proprietors sometimes, however, have their pits constructed of wood in order to save first cost, but this generally results in being more expensive in the end.

If the precautions that I have mentioned, relative to protecting meters, are taken, they are very rarely injured by the cold weather.

DIFFERENT KINDS OF METERS IN USE.

On Dec. 31, 1887, the following water meters were in use in Providence:

KIND.	SIZE.							Total.
	⅝"	¾"	1"	1½"	2"	3"	4"	
Union piston	2,963	580	138	46	6	....	....	3,733
Union rotary	1	....	22	26	3	7	3	62
Crown	3,057	488	121	47	15	3	3	3,736
Fales, Jencks & Sons	15	11	2	....	....	....	....	28
Worthington	61	1	...	....	1	....	1	64
	6,037	1,080	285	119	25	10	7	7,623

The first meters were set in Providence in the year 1872, which was the year following the first introduction of Pawtuxet water into the city.

The Union piston meter was the first kind used. During the first year (1872) 589 of them were set. There were 3,733 in use on Dec. 31, 1887, which is the largest number that ever were in use in Providence. The average number that have been set per year, during the last 7 years, is 16. The bodies of these meters, for sizes below 1½ ins., are of bronze, with iron heads; and for sizes of 1½ ins. and upwards they are of iron, brass lined, with iron heads.

The second kind of meter used was the Worthington, which was first set in 1873. During this year 115 of them were set. The largest number that were ever in use in Providence is 168, which was in the year 1876. On Dec. 31, 1887, there were 64 of them in use. The bodies of these meters are of iron.

The third kind of meter used was the Fales, Jencks & Sons', which was first set in 1874. During this year 19 of them were set. The largest number that were ever in use in Providence is 580, which was in the year 1877. On Dec. 31, 1887, there were 28 of them in service. The bodies of these meters are of bronze.

The fourth kind of meter used was the Union rotary, which was first set in 1877. During this year five of them were set. The largest number that were ever in use in Providence is 63. On December 31, 1887, there were 62 of them in service. The bodies of these meters, for sizes below 2 ins., are of bronze; and for sizes of 2 ins. and upwards, they are of iron, bronze lined.

The fifth kind of meter used was the Crown, which was first set in 1880. During this year 52 of them were set. The largest number that ever were in use in Providence is 3,736, which was on December 31, 1887. The average number that have been set per year, during the last 7 years, is 533. The bodies of these meters, for sizes below 3 ins. are of bronze; and for sizes of 3 ins. and upwards, they are of iron.

APPROXIMATE COST OF MAINTAINING WATER METERS IN PROVIDENCE.

The detail meter maintenance account was commenced during the year 1878, but has only been worked up to 1886 inclusive, therefore the figures of cost that I shall mention, will not include the cost of maintaining any of the different kinds of meters previous to 1878 (they all having been in service, with the exception of the Crown), or the cost of maintaining them since 1886.

The total cost of maintaining the Crown meters during the entire period that they have been in service in Providence (6 years), is, not including 11 meters that have been condemned, $1,462.00, and including the condemned meters, $1,659.00. The average cost per year for each time that a Crown meter was repaired or examined, etc., is, not including the condemned meters, $2.85, and including the condemned meters, $3.17. The total average cost of maintenance, from 1881 to 1886 inclusive, for each Crown meter in use on December 31, 1886, is, not including the condemned meters, 45 cts., and including the condemned meters, 51 cts.; also the average cost per year, from 1881 to 1886 inclusive, for maintaining each Crown meter in use during each year, is, not including the condemned meters, 23 cts, and including the condemned meters, 26 cts. All of the other kinds of meters were in service in Providence, before the detail maintenance account was commenced, and with the exception of the Union piston meters, and the Union rotary meters (which are nearly all large sized meters and are generally set on elevator or motor supplies), are gradually being taken out of service, condemned, and replaced by other kinds of meters, I will only mention individually, in addition to the Crown, the cost of maintaining the Union piston meters.

The total cost of maintaining the Union piston meters in Providence, from 1878 to 1886 inclusive, is, not including 121 meters that have been condemned, $13,085, and including the condemned meters, $16,671. The average cost per year, for each time that a Union piston meter was repaired or examined, etc., is, not including the condemned meters, $3.10, and including the condemned meters, $3.67. The total average cost of maintenance from 1878 to 1886 inclusive, for each Union piston meter in use on December 31, 1886, is, not includiug the condemned meters, $3.74, and including the condemned meters, $4.75; also the average cost per year, from 1878 to 1886 inclusive, for maintaining each Union piston meter in use during each year, is, not including the condemned meters, 44 cts. and including the condemned meters, 53 cts.

In Providence the manufacturers of the Crown meters bear the expense of all the repairs, due to defects in the meters, that are made on them during the first 3 years that they are in service; and the manufacturers of the Union piston meters bear the expense of all the repairs, due to defects in the meters, that are made on them during the first year that they are in service. This expense was included in working up the preceding figures relating to the cost of maintaining the Crown and Union piston meters, as I wished to ascertain the entire cost of maintenance, without reference to who bore the expense.

Included in the preceding figures, relating to the cost of maintaining the Crown and Union piston meters, are several charges which are not due to any fault of the meters themselves, the most important of which are those of repairing frozen meters. I have not as yet had time to investigate this side of the question as thoroughly as I would wish; but I shall not be very far out of the way in saying that the total cost of maintaining the Crown meters, not including the condemned and frozen meters, is $806, or 45 per cent. less than the preceding figures relating to the Crown meters, and including the condemned and not the frozen meters, 1,003, or 40 per cent. less; and the average cost per year for each time a Crown meter was repaired or examined, etc., not including the condemned and frozen meters, is $1.95, or 32 per cent. less, and including the condemned and not the frozen meters, $2.36, or 26 per cent. less. Under the same conditions the total cost of maintaining the Union piston meters, not including the condemned and frozen meters, is $12,398, or 9 per cent. less than the preceding figures relating to the Union piston meters, and including the condemned and not the frozen meters, $15,404, or 8 per cent. less; and the average cost per year for each time that a Union piston meter was repaired or examined, etc., not including the condemned and frozen meters, is $2.89, or 7 per cent. less, and including the condemned and not the frozen meters, $3.51, or 5 per cent. less.

A GENERAL CLASSIFICATION OF THE NATURE OF THE WORK CHARGED, FROM 1881 TO 1886 INCLUSIVE, TO THE MAINTENANCE ACCOUNT OF THE DIFFERENT KINDS OF WATER METERS USED IN PROVIDENCE.

For the Union Piston Meters.

	Times.
Yokes worn	54
Shafts worn	705
Cranks worn	8
Piston connections sprung	6
Shafts broken	13
Shafts bent	6
Cylinders indented	17
Piston worn	19
Piston sprung	12
Piston bound	14
Stem gears worn	32
Valves worn	10
Did not register	11
Examined	262
Miscellaneous	99
Dials clouded	194
Glasses broken	88
Covers broken	9
Clock work out of order	50
Worn	431
Rusted at heads	551
Frozen	193
Surface water	88
Leaked at stuffing box	123
Leaked at heads	22
Nuts loose	200
Packings blown out	19
Solder in meters	6
Cylinders burst	7
Condemned	69

For the Worthington Piston Meters.

	Times.
Spindles bound	156
Leaked at spindle	17
Rusted	69
Miscellaneous	39
Condemned	72

For the Fales, Jencks & Sons' Blade Meters.

	Time
Blades bound, etc	988
Frozen	76
Leaked at stuffing-boxes	45
Leaked at rings	9
Clock work broken off	10
Clock work out of order	19
Worked hard	23
Rings blown off	10
Did not register	14
Rust in meter	13
Miscellaneous	36
Condemned	441

For the Union Rotary Piston Meters.

	Time
Rusty	9
Pistons	10
Shafts worn	8
Worn	9
Caps worn	6
Obstructions in meters	6
Frozen	6
Leaked at Stuffing boxes	7
Glasses broken	5
Floats bottomed	19
Dials clouded	5
Miscellaneous	21
Condemned	3

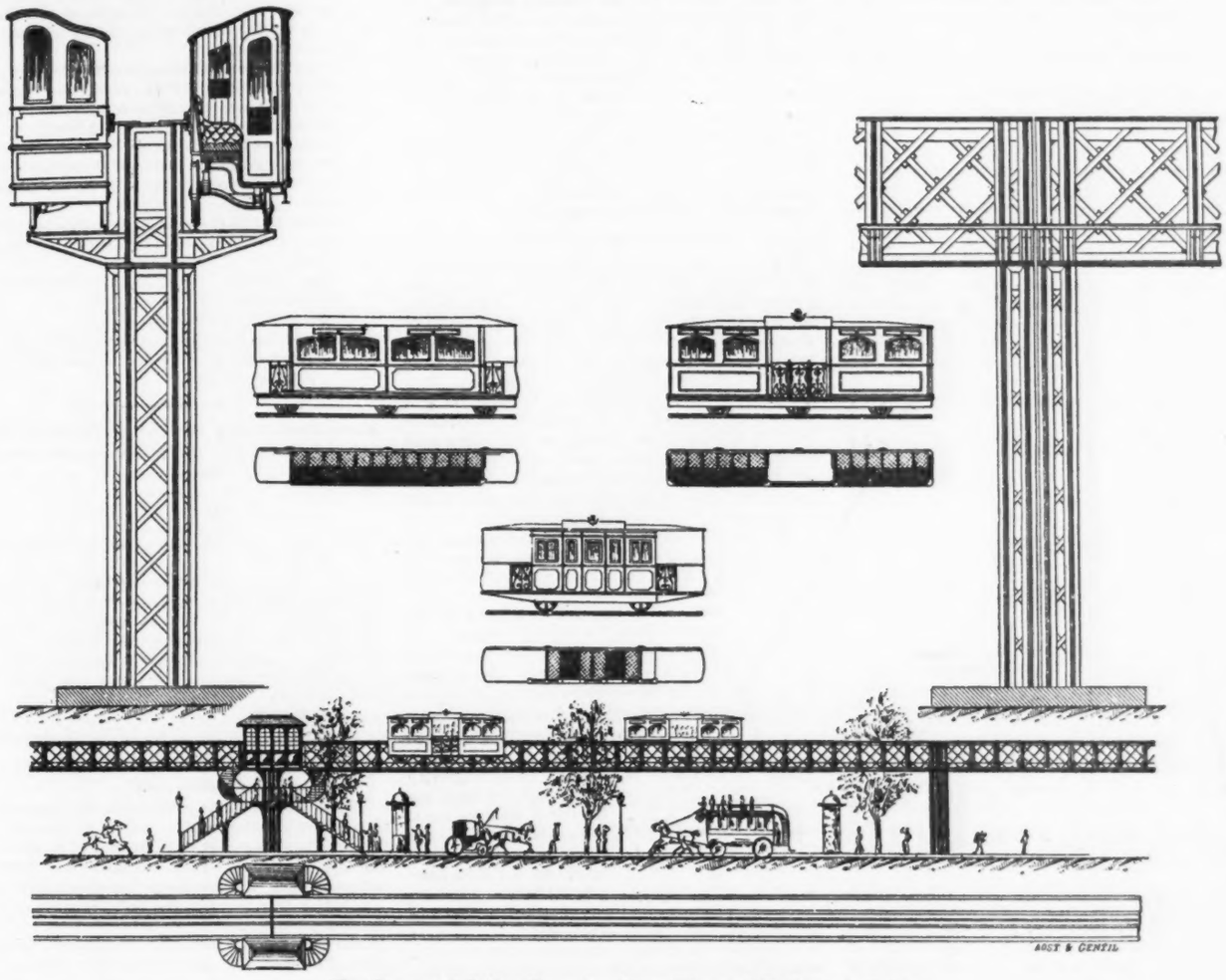
For the Crown Rotary Piston Meters.

Which is the total, from the year that they were first introduced in Providence. The other meters, it must be remembered, had been repaired more or less, before the detail repair account was commenced.

	Time
Frozen	98
Hot water	48
Leaked at stuffing boxes	59
Piston spindles broken	45
Packings blown out	18
Glasses broken	19
Obstructions in meters	36
Rust in meters	14
Clockwork out of order	27
Dials clouded	5
Leaked at couplings	8
Pistons broken	5
Examined	66
Miscellaneous	69
Condemned	11

The total cost from 1878 to 1886 inclusive, of maintaining all the different kinds of meters in use in Providence, is, not including 678 meters that have been condemned, $19,910, and including the condemned meters, $38,184. The total average cost of maintenance, from 1878 to 1886, inclusive, for each meter in use on December 31, 1886, is, not including the condemned meters, $2.79, and including the con-

demned meters, 85.35; also the average cost per year, from 1878 to 1886 inclusive, for maintaining each meter in use during each year, is, not including the condemned meters, 44 cents, and including the condemned meters, 78 cents.



The Proposed Julien-Tournier-Broca Elevated Railway in Paris.

The terms used in the preceding classification are those used by the men who repaired or examined the meters. I have not attempted to correct them, technically or otherwise.

The items specified by the word miscellaneous, are the class that has not occurred individually five times.

Proposed Elevated Railway in Paris.

French engineers are still busily figuring upon the improvement of rapid transit in Paris, and the latest suggested forms, as shown in *Le Génie Civil*, of July 14, are modifications of the Lartigue system as shown herewith. Engineers JULIEN, TOURNIER, BROCA and LARTIGUE advise the immediate construction of a system of elevated structures prior to the opening of the Exposition of 1889, in main lines at least. They disclaim any intention of replacing or suppressing the general project of metropolitan railways, but propose to partly solve the double problem of relieving the present highways of traffic and to give the traveling public cheap and rapid transit.

The Julien-Tournier-Broca system, Fig. 1, proposes a metal viaduct of a minimum height of 16.4 ft. above the street, with trusses of 104 to 130 ft. spans; each truss having its own posts. The two latticed trusses would be placed 1.96 ft. apart and rigidly braced laterally, forming in fact a box-girder so as to resist torsion and flexure. To these beams would be fixed lateral brackets, 5.57 ft. high, carrying steel Vignoles rails, placed 2.79 ft. apart. The posts would be latticed and rest in beton sockets. The small width of this structure would permit its location upon the edge of pavements without inconveniencing the property holders along the outer boulevards where it is proposed to locate this route.

Section of the Lartigue Elevated Railway.

The method of access is shown on the cuts. The carriages could be any one of three different types shown; they are simply the tramway cars cut in two longitudinally, with 20 places for passengers, 12 inside and 8 outside. To insure against accident a forged-iron attachment to the back of the car slides in a T-beam fixed to the trusses. Either cables or electricity may be the mode of traction.

The LARTIGUE system is shown in Fig. 1 and is of familiar application. The truss here would be made up of two members inclined towards each other and having a height of 5 ft. and width of 2.8 ft. This structure would furnish the minimum obstructions to air or light along the route and the cars would be built to pass around curves of 82 ft. radius. The stations would be similar to those shown in Fig. 1.

These roads would be run somewhat after the method on American elevated structures, the price being uniform and the tickets purchased and deposited before entering the train. The promoters estimate the daily traffic of Paris, by omnibus, tramways and steamers on the Seine, at 800,000 persons, with a mean distance for each traveler of about 5,000 ft. or nearly one mile. On the route proposed and doubling the distance per individual, the engineers estimate that at 2 minute intervals, 50 persons to a train and 20 hours work per day, they could carry 200,000 people daily, or 80,000,000 per year. The completed system of about 72 miles they think would have a capacity of 500,000,000 per annum.

THE FIRST RAILROAD TICKET.—There lies before me a thin piece of pink paper, 4¼ ins. long and 1¼ ins. wide, thus worded.

LIVERPOOL TO MANCHESTER.

No 52 12 Sep 1832
at 2 o'Clock from Railway Station
Paid 5s. 6d. J H. Agent

N. B.—When seated, be pleased to hold this ticket in your hand till called for. (Turn over)

On the other side:

NOTICE.—No gratuity allowed to be taken by any Guard, Porter, or other Servant of the Company.

Smoking in the First Class Carriages is strictly prohibited.

The number of the ticket and signature of agent are in manuscript; the day and month are impressed by a separate stamp.—*Notes and Queries.*

THE population of the Russian Empire, according to recently published Government statistics, is 108,787,235. Of these 81,725,186 are in Russia proper, 10,136,723 in European provinces, and the remainder, 16,925,325 in Asiatic Russia.

On the Determination of the Profile of High Masonry Dams.

ISAAC MORLEY, C. E.

Let W = the weight of masonry for one foot in length of dam above any given joint = sectional area multiplied by 1 ft.

u = distance of the point of intersection of weight and pressure with the joint to the down stream end of joint when the reservoir is full, and equal to the distance of the projection of the centre of gravity of the masonry upon the joint from the up-stream end of joint when the reservoir is empty.

x = distance between these two equal values of u.

h = depth of joint below surface of water.

p = pressure at ends of joint.

M = moment of water pressure = $10.417\ h^3$.

$A + 1$ = any given factor of safety.

$l = 2\ u + x$ = length of joint. (c)

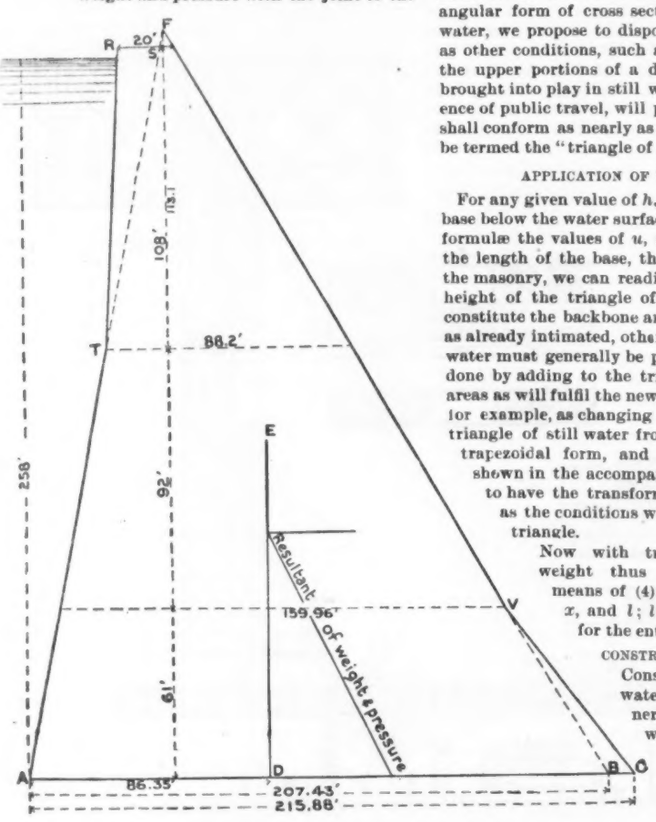


Diagram for Determining the Profile of a High Masonry Dam.

Now, it may easily be shown that

$$W = \frac{M}{x} = \frac{MA}{u} \qquad x = \frac{u}{A} \qquad \text{(a)}$$

Accepting as true the fundamental equation,

$$p = 2\left(2 - \frac{3\,u}{l}\right)\frac{W}{l} \qquad \text{(b)}$$

By means of (a) (b) and (c) the following equations are readily obtained:

$$p = \frac{(2A+4)\,WA}{u\,(2A+1)^2} \qquad (1)$$

$$W = \frac{p\,u\,(2A+1)^2}{A\,(2A+4)} = \frac{M}{x} = \frac{MA}{u} \qquad (2)$$

$$u = \sqrt{\frac{M\,(2A+4)}{2{,}000\,p}}\ \frac{A}{2A+1} = \sqrt{\frac{10.417\,h^3(2A+4)}{2{,}000\,p}}\ \frac{A}{2A+1} \qquad (3)$$

$$u = \frac{WA\,(2A+4)}{2{,}000\,p\,(2A+1)^2} \qquad (4)$$

$$x = \frac{u}{A} \qquad (5) \qquad l = 2\,u + x \qquad (6)$$

By means of (2) (3) (4) and (5) the weight, and the values of u and x, and consequently the length of the joint, for any given factor of safety, and, for any given pressure may be readily obtained:—this is true when the joint under consideration is the base of the dam; to the consideration of this case we shall more particularly direct our attention.

With regard to the disposal of the weight above the base, we have but one limiting condition, viz., the equality of pressures at its extremities; hence we are at liberty to dispose of it in any manner not inconsistent with this condition; and as the triangular form of cross section is the best for still water, we propose to dispose of the weight, so far as other conditions, such as increased strength at the upper portions of a dam to resist forces not brought into play in still water, or, for the convenience of public travel, will permit, so that its profile shall conform as nearly as possible to what might be termed the "triangle of still water."

APPLICATION OF THE FORMULÆ.

For any given value of h, that is, the depth of the base below the water surface, compute by the above formulæ the values of u, x, w and l. Now having the length of the base, the weight and density of the masonry, we can readily compute the area and height of the triangle of still water which is to constitute the backbone and ribs of our dam. But, as already intimated, other forces than that of still water must generally be provided for; this can be done by adding to the triangle of still water such areas as will fulfil the new condition imposed, such, for example, as changing the upper portion of the triangle of still water from the triangular to the trapezoidal form, and lengthening the base as shown in the accompanying figure, taking care to have the transformed section vary as little as the conditions will allow from that of the triangle.

Now with trapezoidal area and the weight thus increased, compute by means of (4) (5) (6) the new value of u, x, and l; l being the length of base for the entire weight.

CONSTRUCTION OF THE PROFILE.

Construct the triangle of still water, $A\,B\,F$, in such a manner that its center of gravity will be projected upon the base at a distance equal to u, determined for the whole weight from the up stream end of the base.

Now the center of gravity of the triangle will not generally fall exactly in this point, but so near to it, that for the purpose of construction we may, without material error assume it to be so: the correction being made when the additional areas have been added as shown in the accompanying figure, by addition of the two small triangles $R\,S\,T$, $V\,B\,C$, so arranged that the center of gravity of the entire area shall be projected upon the base at the distance u, from its up-stream end.

As an example, draw the line $A\,C$ equal to the length of base for the entire weight; make $A\,B$ equal to the base of the triangle of still water; take the point D, distant u, from the up-stream end of the base; at this point erect the perpendicular, $D\,E$, — the center of gravity of the entire area must be in this line, and the center of gravity of the triangle of still water will not deviate far from it. To aid in the construction let us suppose, for the moment, that its center of gravity is in this line, and construct the triangle accordingly; now add to the triangle the additional area required, in such a manner that the center of gravity of the entire area, thus increased, shall fall in the line, $D\,E$, as required.

To illustrate the formula by an example, let us take the case of the proposed Quaker Bridge dam. We will suppose the top of the dam to be 20 ft. wide, and of the form shown in the accompanying figure. We will also suppose that the top of the dam is 261 ft., and the surface of the water 258 ft. above the base; and that the weight of the masonry is 156.25 lbs. per cu. ft., and the pressure at the extremities of the base equals 16.63 tons per sq. ft.

Assuming a factor of safety equal to 3, what will be the length of the base and weight of masonry necessary to support a body of still water 258 ft. in height? By the proper substitutions in (3) (5) we find the following values:

$u = 82{,}947$
$x = 41{,}487$
$l = 2\,u + x = 207.43$ ft.

We find, by means of (2), the weight corresponding to this value of u, and the assumed value of $p = 16.63$ tons; the height and sectional area of the triangle of still water just determined, will be respectively 266.1 ft. and 27597 sq. ft., the weight being equal to 2156 tons.

Now let the area of triangle of still water be increased by the addition of the two small triangles shown in the drawing, and be equal to 28721 sq. ft., thus giving the dam the trapezoidal form.

Assuming, as before, a factor of safety at the base, (this is the minimum factor of safety) of 3, and a pressure of 16.63 tons, what will be the length of base now required?

With the weight corresponding to this entire area of 28721 sq. ft. find by means of (4), (5,) the values u and, x, then;

$u = 86.35$ ft.
$x = 43.175$ ft.
$l = 2\,u + x = 215.88$ ft.

It is to be observed that by the conditions imposed by (a), the resultant must always pass within the middle third of the base.

From Preliminary to Track.—Points in Railroad Construction for Young Assistant Engineers.

BY MILNOR P. PARET, C. E.

The author of this paper has had many talks with young and inexperienced men, or those who may have had some experience in other lines of surveying or engineering work, but who know next to nothing about the ordinary methods and routine to be pursued in both field and office work on railroad construction, and for that reason have felt backward about assuming duties for which otherwise they may have been excellently adapted. To such, the author offers the result of notes made during some of his practice. If the paper be simplicity personified, and yet practical, its end is reached.

PRELIMINARY.

This work has but two objects in view, namely: to obtain information, and to obtain it rapidly. Do not sacrifice time on any pagan altar of detail or accuracy. It will not be a matter of life and death, if, after the work is finished, it is found that the levels are half a foot out; or the deduced and magnetic bearings do not check by a degree; or if a building is ten feet farther from the line than you show it. This, however, does not mean either to encourage or condone slovenly or careless work; by both precept and example you should teach your men to do careful and exact, as well as rapid work. And remember that in all work, be it Preliminary, Location or Construction, example goes much farther than precept.

To get the best service out of your corps it is often advisable to tell them beforehand what is to be done and how it is to be done. Most of your men will be found more than mere automatons. If the pick of the party is to be with you on the later location or construction, a little patience and good humor to such an end is a very good investment. The general direction of the line will be given you by the Chief Engineer roughly traced on county or other maps. In the transit party, put your best man at front chain, and if in a fairly clear country, your next best, at the axe. See that your transit man is painstaking and keeps accurate, full, and distinct notes. Unless you were born with a silver spoon in your mouth, your back flagman, when wanted by the transit man, a mile away, will be doing one of three things: sleeping under the chestnut tree alongside his plug, be in the adjacent apple orchard, or begging a drink of the farmer's pretty daughter.

We will suppose the line to run through a fairly well developed and settled country. The levelman should be rapid with his level as well as with figures, his rodman intelligent and quick on his feet. It is good practice to run simply the center line for a day or so, s_y until you are five or six miles each way from temporary headquarters, then go back and get contours, topography, etc. I have found that better headway could be made in this way, than by endeavoring to finish everything up as the party

goes along, for three reasons: You need not scant your transit party for topography or contour work; the ground having been gone over once by the men, they can do the subsequent development in a much more intelligent manner, and again it enables the draftsman in the office, to plot center line, profile etc., while the men are taking the contours and topography and *vice versa*.

Again your line may be too high or too low, and if the topographer is close up with transit party he is doing work which will be of no use. In the center line work, zig-zag or offset, in preference to doing much clearing. It is quicker. Make instrument points of course with a view of getting long sights as well as making the point permanent; put plugs near fences, where they will not be plowed up, and notch the fences where the line crosses. The levelman's benches should not be farther apart than 1200 ft., and nearer if time is given. In all level work preliminary location or construction, the rodman should keep check notes on all T. P.'s and B. M.'s. He should not peg down short hollows, but take "shinned" rods, unless top of rail of a railroad crossing, or water surface of an important stream is wanted.

The transit and level notes should be copied at night into duplicate books, both to guard against the loss of a field book and to enable the draftsman always to have such notes in the office. The topography party (three men is enough), must take property owners' names, the plus and course of intersected property lines, farm buildings, streams, woods, small settlements, mills, quarries, or other industries, county and other roads, or railroads; this should embrace the country from ¼ to ½ mile on each side; if there is possibility of a location farther to one side than this, an alternate line should be run. County or public road crossings should be located far enough from the line to embrace a cross road so that further topography may be added from county maps; note also the right angled width of roads and streets.

If stones on county or section lines are found and used, their location should be carefully recorded in the note book. If running through or near any town of which a large scale map can be obtained, locate only a few principal corners and street lines. To get a group of buildings some distance from the line, locate the principal one by either polar coördinates or intersecting angles, and the other by sketch and measurement from it. Locate buildings near the line by right angle offsets.

The contour party can best be made up of a levelman, a rodman, 2 chainmen, and a man to keep the notes. The levelman has his note book with elevations on the line, etc., and the note man a topography board about 14 x 20 ins. and he plots the contours to scale on sheets of cross-section paper pinned to the board with thumb tacks.

Five or ten foot contours with occasional elevations should be taken according to nature of ground. To obtain the contours, run out cross-sections at right angles to center line every 200 to 500 ft., use a surveyors cross to turn the right angles, and a hand level when out of range of the Y level; when such lines come near to other topographical features they should be sketched in by the note man as a check on, and aid to the topography party. The contour party should also take extreme high and low water marks of all streams, top of rail and grades of all railroads, the fall and cross-sections of streams, the elevation of floor of bridges as well as their span, width and character, and the profile each way of roads crossed. Make *all* field notes full and complete; better too much information than not enough. All *estimated* distances, elevations, or dimensions should be noted *as such*.

Keep a diary of the work and so on; let it include the weather (you may want to tell the Chief Engineer that the reason you only ran 5 miles instead of 15 was "because it rained.") Note when rock shows at the ground surface or in quarries, of what nature and whether fit for masonry, also the probable nature of foundations. Watch your profile and consider in your topography that spoil banks or borrow pits may be needed, or siding thought of in connection with some adjacent mill, quarry, or other industry. There will likely only be two maps of the survey to make, one to scale of 1 in. equal to 100 or 200 ft., and one to scale of 1 in. equal to 800 or 1000 ft. Keep the maps and profile up to date as closely as possible. Also project a paper location, and plot the profile of the projected line, and from this latter make a rough estimate of the grading and masonry with the probable classification. Try to have the maps, profile and estimate finished a day or so after the field work is finished. The Chief Engineer will undoubtedly revise your projected alignment and grades quite materially, but do not let this deter you; the estimate will be of assistance to him, even should your line be changed entirely.

In conclusion, you can not be too well-informed on such subjects as value of property, distance to and population of adjacent towns, comparative hauls as to other shipping points or markets, probable classification of business industries, stone for masonry, and all such points which may in any way affect the location, construction or operation of the road. In talking over the results of the survey with the Chief, a great many such points will come up, and it is well to have knowledge and opinions on such subjects, even should there be no call for them. Keep on good terms with the farmers and property owners, and show an interest in the welfare and comfort of your men.

LOCATION.

For this work the party will probably consist of a transit man, two chainmen, an axe man and a back flagman, a levelman and a rodman. If the line runs through a very thickly settled country, you will require additional help in taking topography. Try if possible to obtain new instruments, and have an extra transit and level; accidents are liable to happen, and it would be inconvenient, to say the least, to have to wait for a week or ten days while an instrument is being repaired. Have a hand level, two level rods, plenty of metallic tapes and a steel tape (50 feet.) Link chains are out of date; by all means use a chain tape (100 feet) on the center line. Remember that in location all the work must be done carefully and be as exact as possible to be of any service whatsoever; some guess work may be allowed in preliminary, but never in location.

Station.	Alignment.	Deflect.	
142			
140	N. 0° 00' 30" W. (N. 0° 10' W.)		
138			
. + 40	P. T.	2° 00'	
137		1° 48'	
136		1° 18'	
135	1° to Rt. for 4°.	0° 48'	
134		0° 18'	
. + 40	P. C. C.	4° 43.2'	P. I. inaccessible Plugs on T's produced 109.6 from P. C. & 86.4 feet from P. T.
133		4° 07.2'	T=157.7
132		2° 37.2'	P. I. is 20 feet north of small Hickory.
131	3° to Rt. for 2° 30'.	1° 07.2'	
. + 25.3	P. C.		
130			
128	N. 13° 45' W. (N. 13° 45' W.)		
. + 20			
261			

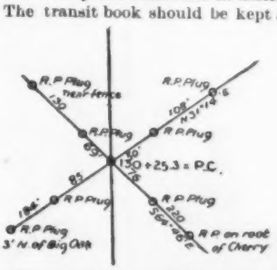
Transit Notes.

There will be a preliminary map with a paper location shown on it, which is to be run; the tangents are fixed by known distances from the preliminary line or topographical features. It is always best to run out *P. I's.* in putting in the curves, but is often more convenient to run a long chord, making it from *P. C.* to *P. T.* as nearly as possible. Of course it is often impossible to run out the *P. I.*, and in case of long and frequently compounded curves, it is better to change the *P. C. C.*, and so bring the line where it is wanted. In many cases it is desirable to assume a *P. C.*, and run hurriedly a trial curve and so find the proper *P. C.* All such problems and many others are given in "HENCK."

There is no field book better qualified for this work than HENCK, probably once in a lifetime you may need a problem not in his book; but in case any other author had it, the latter might lack many good points which HENCK does not. The transitman should have some one check all his calculations, it would be embarrassing to run a long compound curve and find it did not hit the *P. T.* by about 20 ft., because there was an error in figuring. The length of curves, the *P. I.* distances, etc., must of course be noted in the transit book; the deduced and magnetic courses should check closely.

The foregoing is a convenient form of note-book which explains itself.

Chainmen should use plumb-bobs to measure with and give short sights with them; it is much more accurate, and with a little practice they can become very expert. Unless the country is very rough, curves should check out within a couple of tenths for measure and a couple of minutes for deflection. Should the line be a primary or trial location, it is quite likely that it will at least be revised at certain points several times if not changed completely, making the final location a compound of the various lines. Land damage questions are the most fruitful source of revisions in thickly settled countries, and they cannot be definitely arrived at until a trial location has been made. But such thoughts as these must not deter you from having the information exact. You may be called on for a profile or maps by the Chief, to be in by a certain date; better be a day late than send in useless information. The transit book should be kept as clear



Note on Topography Page; Referencing a P. C.

as possible from a confusion of topography notes; for this purpose the transit party should take only such topography, say roads, streets, courses and places of property lines, streams, etc., as are directly crossed or affected by the center line. Have a separate book for topography, with only the center line notes copied from the transit book. In case of much topography, a plane table is, perhaps, the best way of obtaining it. Remember that, as in preliminary, the best possible location of any features is by right angled offsets.

Contours and topography need not be taken, generally, farther than from 100 to 500 ft. from the line and not often so far as 500 ft. off except in case such information is wanted to complete maps, rather than with a possible view of a revised location being thrown that far from the first line; when revisions are so decided upon, it were better to run a separate location. The contour party is the same as on preliminary, except that the rodman can also take front chain. The contours are also taken in the same way, save that cross sections should be run out at every station, with occasional pluses if necessary, and contours taken not more than every 5 ft. in elevation. Maps of various scales will have to be made, from 1" = 40' to 1" = 200'. The most suitable profile paper generally is Plate A: 1" = 200' horizontal and 1" = 20' vertical. Beside the levels on the center line the levelman should take high water mark of all streams, and their fall; floors of all adjacent bridges, as well as span, etc.; grades each way for 200 or 300 ft. of all roads, railroads, etc. Benches should be set not farther apart than 1,000 ft., and far enough from the line not to be endangered by the construction, and their character and location carefully noted; and bear in mind for the sake of the future that *B. M.'s* nearest pieces of masonry are the most frequently used. The level should be kept always in good adjustment; 2 or 3 tenths difference in levels on location is quite serious.

A good form of level book is this: In the + and — columns put rods on turning points and *B. M.'s* only, in the intermediate column put rods on center line only:

Sta.	+	Int.	—	H. I.	Elev.

Bear in mind that the maps and profiles are to

give distinct and reliable information, for example: on maps, the outlines of a building in its correct position are not sufficient; mark on it also, "house, new, two-story brick"; or the plan of a bridge is not of itself enough; note, "county bridge covered *cl. sp.* 100 ft.; *cl.* width 18 ft.; *cl. ht.* 15 ft." And treat all other features similarly. Do not forget, on maps the scale and meridians, or that the courses of tangents should read the way the line runs. On the profile, show extreme high water of streams, elevation of floors of adjacent bridges; cross-sections of rivers and nature of bottom; note "road rises on left 25 ft. in 200, falls on right 20 ft. in 200." If the line parallels a river, canal, or railroad, show the profile of that also. Show the alignment by a red line at top of profile, and at foot also, of the property lines and owners. Even notes on points which are not directly pertinent to the profile, are often desirable. A profile with too much information on it is a fault of the right sort.

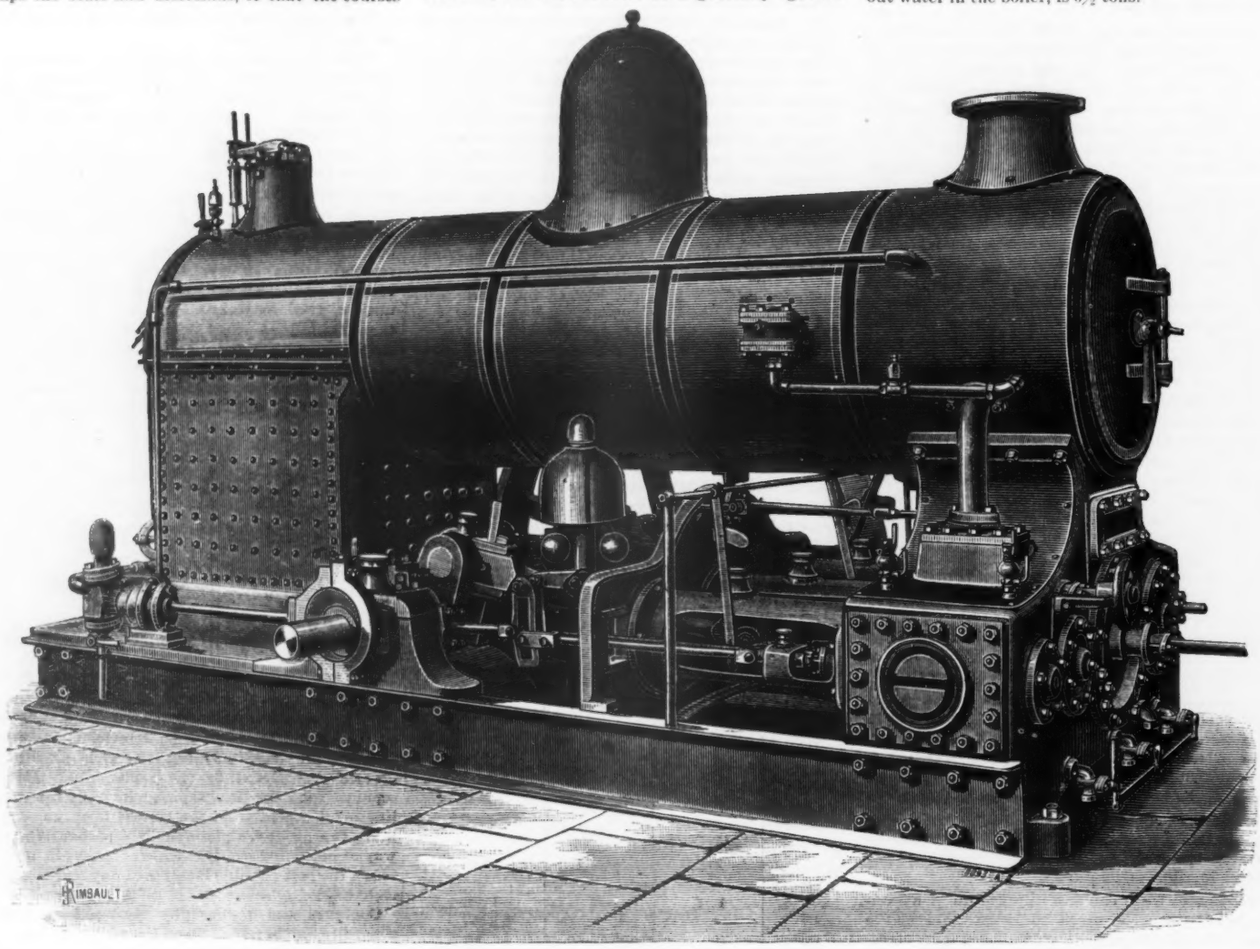
TO BE CONTINUED.

SOME of the New York City theatres now provide iced air for their patrons. The Standard theatre uses about two tons of ice in this way every evening. A fan in the basement draws in the outside air, which on its way to this fan, passes over ice placed on shelves. The temperature is thus easily reduced to 70° Fahrenheit. A second fan is placed on the roof and exhausts the air from the interior, so that there is a constant change of atmosphere.

AT a meeting held recently at Birmingham, England, the plan of Mr. SHEPHERD, C. E., for the construction of a canal for vessels of 300 tons burden between Birmingham and the Weaver Navigation, was considered, and a committee was appointed to investigate details; the general sentiment was favorable to the scheme. Ten alterations of level are to be accomplished by using hydraulic lifts. The estimated cost, including the purchase of land, is $8,000,000.

Triple Expansion Semi-Portable Engine.

Triple expansion has heretofore been confined almost exclusively to marine engines, which fact is certainly surprising, considering the undoubted advantages gained by using three cylinders. These advantages are recognized and appreciated by shipbuilders, but seem to have been generally ignored by makers of stationary engines. An English firm has at last taken the matter in hand, and has produced the above type engine, of which we give illustrations and a brief description, for which we are indebted to *Industries*.



Triple Expansion Semi-Portable Engine.

GENERAL PARTICULARS OF BOILER AND ENGINE.

BOILER:	
Length of barrel	6 ft. 2 in.
Diameter of barrel	2 ft. 6¾ in.
External width of fire box	2 ft. 7¾ in.
External length of fire box	3 ft. 6 in.
Height of fire box from grate	2 ft. 10 in.
Area of grate	6.3 sq. ft.
Number of tubes	38
External diameter of tubes	2 in.
Length of tubes	6 ft. 3 in.
Heating surface of fire box	34 sq. ft.
Heating surface of smoke box	4 1 sq. ft.
Heating surface of tubes	120 sq. ft.
Total heating surface	158.1 sq. ft.
Heating surface per square foot of grate	27.74 sq. ft.
Pressure of steam per square inch.	175 lbs.
ENGINE:	
Diameter of cylinders	5½ in., 9 in., 15½ in.
Length of stroke	14 in.
Revolutions per minute	150

On account of the high pressure of steam employed, piston valves have been substituted for flat slide valves on the high pressure cylinder, which is equipped with a main and an expansion valve of this type. Ordinary slide valves are used on the other two cylinders. The arrangement of cylinders, the low pressure between the other two, is shown in the end elevation. The piston rod of the low pressure cylinder is prolonged through the back cover for attachment to the air pump, if the engine be used as a condenser.

All the cylinders are jacketed with live steam. The crank shaft is carried in four bearings, the plummer blocks being one casting with the pedestal which supports the fire box. The frame of the engine consists of steel channel girders. The fly wheel is 5 ft. 6 in. in diameter and 10½ ins. wide, and the total weight of the complete engine, without water in the boiler, is 6½ tons.

The following is the record of a trial of two hours duration, which shows marked economy in fuel:

Mean I. H. P. during trial	40
Duration of trial	2 hours
Water:—	
Total weight consumed	1140 lbs.
Weight evaporated per lb. of coal	9 8 lbs.
Weight drawn from jackets	84 lbs.
Weight consumed per H. P. per hour	14.25lbs.
Temperature of feed water	55° F.
Coal:—	
Total consumed	116 lbs.
Weight consumed per H. P. per hour	1.45 lbs.
Weight consumed per square foot of grate	10.2 lbs.

Indicator cards taken during the trial showed that in the high pressure cylinder the initial pressure was 175 lbs. above atmosphere, the mean pressure 54 lbs., back pressure 35 lbs. and I.H.P. developed 13.3. In the intermediate cylinder the mean pressure was 18 lbs. above atmosphere, and the I. H. P. was 12. In the low pressure cylinder the initial pressure was about 18 lbs., mean pressure 7.5 lbs., and I. H. P. 14.7, making the total indicated horse power 40. In the opinion of the makers the maximum economy in fuel would be attained by running the engine so as to develop about 50 brake horse power.

THE *most powerful electric arc light* in the world, that at St. Catherine's lighthouse on the Isle of Wight, has carbons 2½ ins. in diameter with an interval between them of ⅛ in., and developes a light of 60,000 candle power. The lens divides the light into 16 powerful rays and is made to revolve by a small steam engine at such a rate that it gives a flash of five seconds duration every half minute.

The Tetrabasic Phosphate.*

The phosphorus, of which all iron ores contain more or less, abides with the iron all the way through the blast furnace, the converter of the acid Bessemer process and the open hearth. Phosphorus is objectionable in steel, and the restriction imposed by common consent, that not more than 0.1 per cent. shall be allowed to be present, excludes more than 90 per cent. of all the known ores of the world from being worked into steel by the acid process.

The basic process enables us not only to eliminate the phosphorus, and so make all ores available, but the phosphorus is useful in developing heat to keep the metal fluid during its treatment. Ore rich in phosphorus is, therefore, best adapted for this purpose. Moreover, during treatment, the phosphorus is oxidized, and afterward deposited as phosphate of lime, a very valuable fertilizer. All grades of metal may be used, but that containing 3 per cent. of phosphorus can be converted into steel of the best quality for $3 per ton less than that containing 0.3 per cent. and, in general, it is better to use metal containing 2 per cent. or more.

The requirement of the basic process is that the phosphoric metal shall be treated in the presence of a highly basic slag, and this is secured by lining the converter with basic material, such as lime, magnesia, chrome ore, etc. On account of the value of the product, lime is generally added to form the slag, through other basic materials would do. When molten phosphoric iron is run into a magnesian-lime-lined converter, and there blown with an air blast while in the presence of lime additions, the silicon and carbon will be eliminated, and the phosphorus oxidized to phosphoric acid and held in the lime additions as a phosphate of lime.

Previous to the introduction of the basic process but three phosphates of lime were known; the one formed in the converter is a new one, a tetrabasic phosphate having the formula $(4\ C\ a\ O)\ P_2\ O\ 5$. In preparing the tetrabasic phosphate for market, it is put through a crusher, then passed through a magnetic separator, in which all particles of metallic iron in a free state are withdrawn from it; it is then put into a pulverizer and reduced by one or more operations to an impalpable powder. When more than one operation is employed, magnetic separation should be used between the different steps, so as to withdraw all particles of iron or manganese from the phosphate. When the tetrabasic phosphate is so formed and prepared, it is put up in 200 lb. bags, and is ready for use.

Analyses of the tetrabasic phosphate show that it contains 21.32 per cent. of phosphoric acid, and is worth $26.12 per ton of 2,000 lbs., or the phosphoric acid is worth 6.12 cts. per lb. Concerning the plant and output Mr. REESE says:

"When 6 tons of metal containing 3 per cent. of phosphorus is used in the basic Bessemer process, and blown in the presence of 3 694 lbs. of lime additions, 4,617 lbs. of tetrabasic phosphate will be produced, containing 923 lbs. of phosphoric acid, which, at 6.12 cents would be worth $56.49, or $9.41 for each ton of metal blown. The cost of grinding, pulverizing and bagging the phosphate will not exceed $1.41 per ton of metal blown. So that when metal having 3 per cent. of phosphorus is blown the phosphate will yield a net return of $8 per ton of steel made.

A basic plant that would turn out 300 tons of ingots per day would produce about 100 tons of phosphate. The grinding plant required to pulverize this amount in ten hours to a fineness such that 85 to 90 per cent. will pass a mesh where there are 10,000 holes to the square inch, or so that 70 per cent. will pass meshes where there are 23,000 holes to the square inch, will consist of four crushers, 12 grinding mills and 16 magnetic separators, together with the feeding and connecting apparatus. An engine of 120 horse power would be required to furnish the requisite power.

In the practice of the basic Bessemer process at Nashville or Birmingham, Alabama, where the ores would only produce a metal containing 1 per cent. of phosphorus, I would use 320 lbs. of an ore found in Virginia that contains 32 per cent. of phosphoric acid, and thus charge the metal with 3 per cent. of phosphorus. This 320 lbs. of ore can be furnished at less than $1, so that there will still be a net profit on the phosphate of $7 per ton of steel made. It will thus be seen that the basic Bessemer process may be practised in the manufacture of steel from all kinds of iron ores containing phosphorus in all degrees from .1 to 3 per cent. or upwards."

In concluding his paper Mr. REESE gave an estimate of the amount of phosphoric acid annually withdrawn from the earth in the United States by the various crops, finding the enormous total of 3,256,704,491 lbs. After considering the various means of returning this phosphoric acid to the earth, there is found to be still a deficiency, to make up which would require about 4,000,000 tons of phosphate. The estimated product in 1887 was about 1,000,000 tons; so, if Mr. REESE's figures are correct, there is a fine prospect for the basic process.

*Abstract of a Paper by JACOB REESE, presented at the Seventeenth Meeting of the Am. Soc. Mech. Engineers.

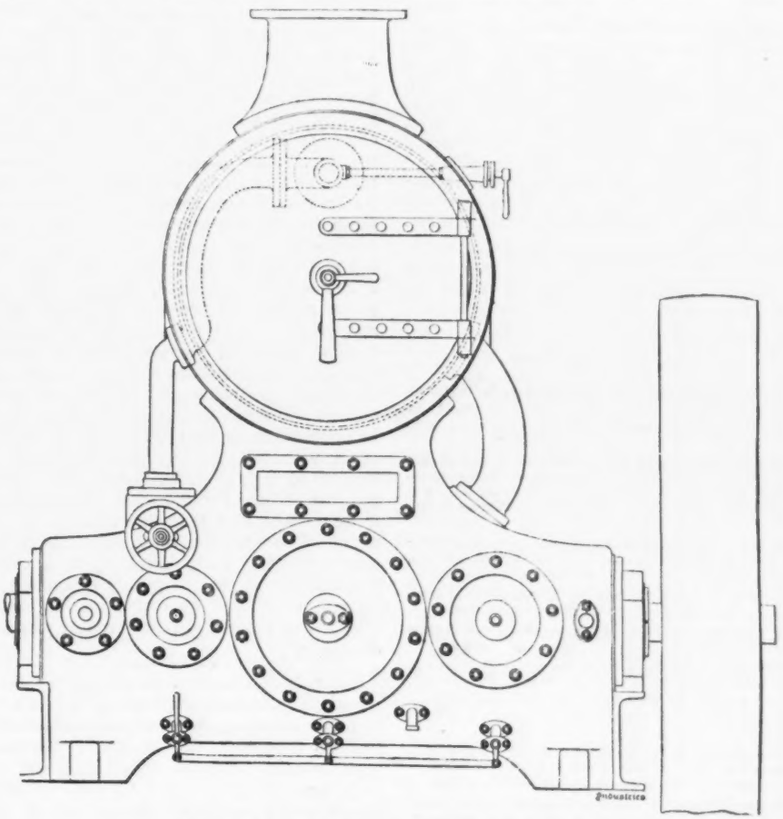
The Hawkesbury Bridge.

Work on this great Australian bridge is progressing satisfactorily, and hopes are entertained of its completion in a few months. The first span was recently put in place on the piers, and the others are soon to be put in position. The launching, transporting, and erection of the first span, which is 416 ft. long and weighs more than 800 tons, was accomplished without accident or delay and with very little effort, by skilfully taking advantage of the tides. This span is exactly in the middle of the bridge, resting on piers 3 and 4. It was built on a pontoon of Oregon timber 315 ft. long, 60 ft. wide, and 12 ft. deep, divided into 44 compartments, and covered with galvanized iron plate on bottom and sides. A trestle about 50 ft. high supported the span during its construction, and until it was permanently placed on the piers. The extreme height of the lifting apparatus used on the pontoon was 120 ft. above its deck.

When the span was completed, the time of full moon and consequent high tide was taken advantage of; a 6-inch manilla hawser was attached to one of the piers, and the other end fastened to a powerful winch on the pontoon 4,000 ft. away. With this, and two steamers, and the tide favorable, the pontoon was dragged off its supports and finally floated into position between the two piers. When the tide receded, the span sank into position, the fit being perfect, so that the bolt holes in the shoe and pedestal plates coincided.

The Mesa Irrigating Canal.

According to the Santa Fé *New Mexican*, this gigantic project, first started in 1876, has been demonstrated by surveys covering 140 miles of the route, to be not only a feasible undertaking but a practical business enterprise which promises well to investors. It is estimated that the work can be done for $1,500,000, and that its completion will add 2,000,000 acres of fertile land to the arable area of the Rio Grande valley. It is proposed to put this land on the market at $10 per acre, $1 payable in cash and the balance in nine equal annual payments. The canal as projected, will be 30 ft. wide at the top, 18 ft. at the bottom, 6 ft. deep, and about 200 miles long. It will tap the Rio Grande at La Joya, and, with its branches and a system of storage reservoirs, will furnish water for the irrigation of the mesa, 200 miles long and 12 miles wide, lying on the east side of the Rio Grande between the river and the Sandia mountains. When this project was first started, owners of land on the mesa were asked to donate one half the land reclaimed as an aid to the projectors of the enterprise, and more than 250,000 acres of land have thus been secured. The high altitude and distance south give New Mexico a mild, equable climate and make it a desirable location for home seekers. It is estimated that the Rio Grande Valley in the limits of New Mexico, if properly cultivated, would be capable of sustaining nearly a million people, the land now irrigated proving that the soil is wonderfully fertile and productive



Front View.—Triple Expansion Semi-Portable Engine.

AN Italian engineer, SIGNOR VICTOR BROCCA, has just completed the survey of the proposed canal across Italy, the object of which is to save the very long journey round Cape Leuca. This canal would begin on the western side near Castro, on the Tyrrhenian Sea, and reach the eastern coast at Fano, on the Adriatic. Its length would be about 180 miles, its breath 330 ft., and its depth 40 ft. For the purposes of the canal it would be necessary to drain the two lakes, Bolsena and Thrasimene. The estimated cost of this gigantic undertaking is $100,000,000.

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D. McN. STAUFFER. A. M. WELLINGTON.

EDITORS.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

New England Roadmasters' Association. — The 6th annual meeting will be held at Boston, Mass., August 15, 16. Secy.: W. F. Ellis, Roadmaster, Providence & Worcester R. R. Woonsocket, R. I.

American Association for the Advancement of Science. The thirty-seventh meeting will be held at Cleveland, O., from August 15 to August 21, 1888. The headquarters will be at the Hollenden. For particulars address F. W. PUTNAM, Salem, Mass.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, Aug. 21. Secy., S. M. Wickersham, Penn Building.

Engineers' Club of Kansas City, Mo.—Regular meeting, Sept. 3. Secy., Kenneth Allen, 19 Deardorff Building.

American Society of Civil Engineers, New York.—Regular meeting, Sept. 5. Secy., John Bogart, 127 E. 23d St.

Roadmasters' Association of America.—Next meeting at Washington, D. C., Sept. 11. Secy., H. W. Reid, Waycross, Ga.

Boston Society of Civil Engineers, Boston, Mass.—Regular meeting, Sept. 19. "House Drainage". Secy., S. E. Tinkham, City Hall.

Association of North American Railroad Superintendents.—Next meeting at the Southern hotel, St. Louis, Mo., beginning Sept. 19. Secy., Waterman Stone, Providence, R. I.

American Institute of Mining Engineers.—Next meeting at Buffalo, N. Y.; beginning Oct. 2. Secy., R. W. Raymond, New York.

Engineers' Club, Philadelphia, Pa.—Regular meeting Oct. 6. Secy., Howard Murphy, 1122 Girard St.

American Society of Mechanical Engineers.—Convention and annual meeting at Scranton, Pa.; beginning Oct. 15 Secy., F. R. Hutton, 280 Broadway, New York.

THE Secretary of the American Society of Civil Engineers makes the important announcement that the Transactions of this Society will be sent to any subscriber at the rate of $10 per annum; and to clubs of ten or more when ordered through the Secretary of an engineering or technical society or club, at 25 per cent. discount. This is a liberal departure from the usual methods of technical societies that will be appreciated by many who are not or cannot be, members proper of the American Society of Civil Engineers.

WE must apologize for our exchange reader in failing to note the source from which he derived two short news items in our last issue; viz, "The Watkins Range Finder", from the *Engineering and Mining Journal*, and "Electric Storage Cars", from *The Electrical World*. We make this note because our attention has been called to the omission by an esteemed contemporary, and because we particularly desire to shift the responsibility for the correctness of the "range finder" item, and for the further reason that we are usually careful in giving due credit.

IN connection with a late editorial on grade-crossings and their dangers, we note the statement in a Chicago paper that since January 1 of this year the coroners of that city have held inquests on the bodies of 126 persons killed at railway crossings in that place. This is a startling record, if anywhere near true, and loudly calls for the suppression of this dangerous feature of railway construction. If this is the total for one-half year in one only of our great cities, the aggregate for the country must assume fearful proportions.

A CLIPPING from one of the papers of this city gives the results of a recent sale of "securities," and therewith tells a tale. The articles disposed of were water-works bonds and stock; $71,000 worth of 1st mortgage bonds of one company sold for $4,000, and $121,300 stock for $1,000; $24,600 of another company's shares for $1,000; $201,500 for $10,000, etc. This means water in more senses than one, and proves, not that the building of water-works is being overdone, but that certain promoters of such schemes are showing either a lack of wisdom or culpable ignorance in starting and over-stocking them. When properly and honestly managed, water-works enterprises are among the most profitable investments to be found in the country, for water is both a luxury and a necessity and the revenue therefrom is liberal and certain. But to bring about this desirable end something more is needed than merely securing a franchise, to be peddled out to the highest bidder, and that often without provious knowledge of the source of supply or probable service other than an estimate based upon the opinions of irresponsible and ignorant agents. As long as investors will take these estimates at their own valuation and figure upon a certain hydrant rental that is purely imaginary, we do not know that we can blame the speculators who trade upon the credulity of their clientage.

But this speculation in a very necessary class of public works is working untold injury to more deserving enterprises, and should be stopped somehow. The numerous failures of water-works schemes, from financial and from natural causes, can be very generally traced to this purely speculative source. The inhabitants of a town or village want water, as everybody does nowadays; a franchise speculator comes to their assistance and promises to supply them with the necessary fluid simply upon the authority of the town council, securing to him a monopoly of the supply, and a promise that the town will pay $100, for example, for each public hydrant. In the early extravagance of a luxury that is yet to be secured, a mythical hydrant is located on every possible street corner and before the doors of favored citizens, and the aggregate is a round one. This is all that the agent wants; he has his franchise and say 150 hydrants at $100 each; and upon this basis he bonds and stocks his airy water-works, and then sets out to dispose of his privilege to the capitalist. If promises of help are secured, usually at ruinous discounts, one of two things very often happens. Either the topography of the surrounding country is such that good water can not be obtained at any price within the ability of the citizens to pay interest upon; or, the works are bonded and stocked to an extent far beyond the demands of the case or any reasonable prospect of revenue. In the one case the works are a failure, either through a complete collapse or a resort to a makeshift supply of unwholesome water. In the other case, even if works of some kind are completed, there is a sacrifice of securities such as is chronicled above, and some one is a loser of hard cash.

The prevalence of schemes of the nature above described would suggest a new departure for responsible hydraulic engineers. That is the opening of an office, not for the design and building of water-works, but to report upon the feasibility and cost of new work, and to advise would-be investors whether or not the enterprise was sound and agreed in all respects with the representations of its promotors. The engineer who possessed the required practical and technical knowledge to perform this duty intelligently and the moral courage and impartial spirit required to do it fearlessly and honestly, should soon establish a growing and lucrative practice. And the good work of a few engineers of this character should soon purify the atmosphere surrounding projects of this kind. If the consulting engineer reported that works bonded for $100,000, for example, could not be properly built for twice that sum, it is very probable that the man of cash would withhold his money. And if, on the other hand, he found bonds to the extent of $200,000 on a proposed scheme that could not return a reasonable revenue on half of it, there would soon be fewer of these forced sales of securities which do not secure the investment. There would probably still be some banking institutions and individuals who would gamble on the event, in the hope of phenomenal gains; but even to them, honest estimates and advice would have a high market value. It is to be regretted that service of this character should be required; but it is more to be regretted that honest enterprise in a direction of great public necessity should be injured by the actions of those who only play with these needs for the money they may find in them for themselves, regardless of the ultimate outcome to the parties who are supposed to be benefited.

ALTHOUGH the latest news from Washington is that the House Committee on Appropriations refuses to concur in the Senate amendment to the Sundry Civil bill appropriating $250,000 for the surveys necessary to test the feasibility of building government storage reservoirs for the irrigation of desert land, it is probable that the committee will have to yield to public demand. Too many people are interested in the discovery that these dry, sterile lands can be turned into gardens by irrigation simply, and that they cover the best soil in the country. Under the present law a condition of securing this land is that it must be reclaimed and irrigated. In most cases this is too expensive a task for the individual, and the consequence is that the irrigation companies very frequently secure to themselves the best of any promising tract, as they already control the water supply. The residents of the States and Territories affected now ask that the Government step in and take possession of the water supply and after reclaiming the land, sell it at a fair price to settlers. This looks like an honest, business-like proposition; and it is one that while originally costing huge sums of money to inaugurate, would doubtless yield greater proportionate revenue to the Government in advancing the interest and improving the condition of its citizens.

TO-DAY decides the fate of the $20,000,000 River and Harbor appropriation, the largest amount ever set aside for this purpose in our history. As it is practically for two years, however, the proper division reduces the annual ratio to less than average proportions]

Rock Fill Reservoir Dams.

II.

THE DAMS OF THE NICARAGUA CANAL PROJECT.

The most prominent constructive feature of the Nicaragua canal project, as modified by the surveys of this year, apart from the locks, may be said to be the dams and reservoir walls. The dams required are:

1. The main Ochoa dam across the San Juan river.

2. The dam which forms the Tola basin on the Pacific end.

3. The dam which forms the Deseado basin, on the Atlantic end. This and the Tola dam are of nearly equal magnitude with the Ochoa dam.

4. A series of ten reservoir embankments mostly of small dimensions, and aggregating in magnitude about that of the single San Francisco valley embankment, of earth and puddle, heretofore proposed, as specified below.

5. A series of low embankments or reservoir walls along the crest of the ridge between the San Francisco valley and the main San Juan valley, at points where it is below the desired flood level of 110 ft.; aggregating some 15,000 ft. in length by 15 ft. high.

All these dams are made under substantially the same conditions; viz., with a great surplus of water supply, so that even a large leakage is unimportant, yet with no danger of very excessive floods, owing to the equalizing effect of the lake, which never rises more than 2½ ft. in the most excessive floods. The dams are likewise in almost uninhabited and more or less malarial and unhealtny regions, where simplicity of plant and construction is a great consideration. Within a few miles of all of them are heavy rock cuts, from which any amount of rock spoil can be obtained at the cost of hauling.

Under these conditions masonry or concrete dams, such as are now proposed for the work,* must necessarily be pretty expensive, and possibly much more expensive than expected; while a rock fill dam has its most advantageous conditions. Thus, for the Ochoa dam, which is 1,255 ft. long by 52 ft. above water, extending down through an average of 6½ ft. of water and 12 ft. of sand and gravel to rock foundation, the first step in building the concrete dam must be the construction of a coffer-dam, which will necessarily be expensive. The dam must then be pumped dry, and earth and rock excavated to a solid foundation. A timber apron on piles must be constructed below the dam. The concrete must be well mixed and rammed. As several years will be required for construction, channels of some kind to permit the passage of the river while the dam is building must be provided. All this implies skilled and faithful labor of several kinds and a good deal of it, a good deal of plant, and very liberal opportunities for expensive "contingencies" so that the following estimate (that in the report of 1885) is certainly not excessive and might well prove to be considerably too low:

ESTIMATED COST OF OCHOA CONCRETE DAM, NICARAGUA CANAL.

[1,255 ft. long on the crest, 52 ft. above water, extending down 20 ft., in all, to rock, through 6.6 ft. (mean) depth of water (17 ft. maximum), and 12 ft. of sand and gravel.]

Coffer dams and pumping	$200,000
77,088 cu. yds. excavation, earth and rock, at $2	154,176
50,585 cu. yds. concrete in foundation, at $9	536,205
82,127 cu. yds. concrete in dams and abuts., at $8	657,016
Total for concrete work	$1,547,457
6,170 piles, about 25 ft. long, at $7.50	46,275
298,188 cu. ft. timber lining and apron, at 50 cts.	149,094
23,241 cu. yds. stone and gravel filling in apron, at $2	46,482
7,000 cu. yds. dry stone wall, at $4	28,000
Total for apron	$269,851
83,334 cu. yds. stone gravel, etc., upper side of dam (2 to 1 slope), at 50 cts.	41,667
Total	$1,858,975
Add for contingencies, 25 per cent. (the general allowance for the whole work)	464,744
Total estimated cost of dam	$2,323,719

Let us suppose, now, the dam to be made by a rock fill in the following manner; premising that seven-eighths at least of the water supply may leak through without doing any harm. The first step must be to build a timber construction trestle with a very open floor a few feet higher than the proposed crest of the dam; and it will be desirable to have dump cars so arranged that earth, gravel and small rock can be discharged between the rails or on the upper side of the trestle, and large stones only on the lower side. Thus, by properly distributing the class of material dumped, possible injury to the trestle by large rocks, such as it is desirable that a large part of the dam should consist of, may be avoided.

The haul on the rock required at Ochoa will be 14 miles, over a level or down grade, being much the longest required for any dam on the route. Assuming that 400 tons or 200 yds. in excavation were hauled in each train, and that it were placed on board cars as a part of the cost of excavation, it will be seen that 50 cts. per cu. yd. would allow nearly $4 per train mile as the cost of hauling and dumping, which would be ample even in that tropical region.

Dumping rock from the trestle as evenly as might be over the entire length of the dam, and chiefly on the lower side, scour would almost immediately commence below the rock dumped, which would allow each succeeding train load of rocks to descend nearer and nearer to rock bottom, and by the time that the fill had progressed far enough to fully protect the foot of the trestle from further wash, the river would have backed up two or three feet and there would be a decided miniature rapid, which would increase in violence with every foot of material dumped, until finally, long before the dam had reached any considerable height, the current over the crest would be violent enough to scour completely down to bed-rock for some distance below the toe of the dam, and to carry rocks of considerable size well out beyond their otherwise natural slope of something under 1½ to 1.

This is precisely what is wanted, and it might even be well to magnify this effect by carrying up the fill somewhat unevenly, so that at certain points there would be a very fierce current, carrying large rocks out for a considerable distance and rearranging the toe of the dam as the violent current was shifted from one part to another. All this, however, after the dam was 10 or 15 ft. high, would take place below the trestle, and the fill of smaller material, carried along on the upper side, would not be (or need not be) greatly disturbed or affected by it, while it would be tending continually to seal the lower part of the dam, and compel all the flow of the river to pass over the crest.

The annual minimum flow of the San Juan river is about 11,900 cu. ft. per sec. and the maximum not greatly more, or only that due to 2½ ft. more head at the lake, 64 miles off. To discharge this would require a head over the crest of about 2 ft., and an actual depth of water over the crest of about 1½ ft. Such a sheet of water, falling 52 ft. down the slope of a rock fill, would have an immense detrusive effect, and the final result might well be that the lower slope of the dam would have a concave profile averaging fully a 4 to 1 slope. This might possibly be obtained by the natural force of the water alone, by intensifying the violence of the current at successive points in the manner above outlined, or it might be obtained by a low auxiliary trestle below the main one to complete the toe of the embankment independently; but, however obtained, such a slope, once made of good sized rock and with a fairly even crest, would be beyond the power of any current passing over it to seriously disturb. If it did disturb it more or less at points, however, at any time during the first few years after construction, the original trestles would remain from which more material could be added. Any considerable washing away of any part of the dam would be impossible, because of the material and mode of construction.

In the meantime the smaller material dumped on the upper side of the dam would naturally assume a slope of about 2 to 1, or could be made to do so by deposits of earth in water. This material, together with whatever sediment might be brought down by the river, would be continually operating to seal the dam, but if it did not do so perfectly, and passages of some size refused to close for several years no great harm could result. Their length would be over six times their depth below water, or nearly 500 ft. under the base of the dam, and devious and irregular passages of this length, which cannot enlarge themselves because of the material, must in time close up by the operation of natural causes alone. Before the water has penetrated far, most of its head is lost, and deposits of whatever sediment there is in it will gradually close the passage.

We have assumed that the current of water was to be permitted to permanently flow over the crest, but while this is not only permissible but desirable during construction to ensure the solidity of the work, it is not necessary after construction. Side channels excavated around the dam through the solid rock at each end may carry off most or all of the normal high water discharge and yet be of moderate cross-section, since they can have a very steep grade. If this be done, less pains need be taken with the construction of the dam itself. In fact, an ordinary 1½ to 1 rock embankment, sealed by earth and gravel on the upper slope, would be of ample strength if no water was ever to run over the crest after the dam was built. But without making any allowance for this, and assuming the dam to have a 4 to 1 slope and side channels besides, we obtain something like the following comparative estimate of cost:

ROUGH COMPARATIVE ESTIMATE FOR A ROCK FILL DAM AT OCHOA.

83,334 cu. yds. stone, gravel, etc., upper side of dam, 2 to 1 slope, as in estimate above, at 50 cts	$41,667
166,668 cu. yds. heavy rock filling, lower side of dam, 4 to 1 slope, at cost of hauling 14 miles after being loaded free of cost on cars, and dumping, say at 50 cts	83,334
80,000 cu. yds. rock filling of smaller rock, for central core of dam (say 50 × 60 × 1,200 ft.) at cost of hauling, f. o. b. cars as above	40,000
1,300 lin. ft. timber trestle 60 ft. high, at $50 per ft	65,000
1,300 lin. ft. lower trestle for completing lower toe of 4 to 1 slope, at $25	32,500
Total cost of dam proper	$262,501
Add for side channels in rock to discharge river around dam after construction, say	50,000
Total	$312,501
Contingencies, 25 per cent. as above	78,125
Total cost of rock fill dam	$390,626
As against, for concrete dam	$2,323,719
Saving (83 per cent.)	$1,933,093

This comparative estimate is of course a very rough one, but it is certainly a fair one, to the extent that the more costly dam is much more likely to exceed the estimated cost than the cheaper form. The great contrast

*The dams must necessarily be of concrete or earth, since suitable stone for masonry does not exist within reasonable distance for either the locks or dams, although there is plenty for concrete or rock fills.

in cost arises from the simple fact that we are working with nature instead of against it. Instead of elaborately excluding water by coffer-dams and pumps, and then excavating the material within, we let the water alone and make it do our excavating for us. Instead of constructing a costly timber apron to resist scour, we cause the scour to do its worst from the beginning. There are places in plenty where this style of construction would not answer; but in all kinds of slack-water work, where there is solid bottom to build on and nothing but navigation interests to be considered, the method is deserving of much more extensive use than it has had.

A conspicuous locality in our own vicinity where this style of construction may yet be applied on a grand scale with great advantage, and where any other seems almost out of the question, is in the canalization of the Ottawa river for large ocean vessels to a connection with Lakes Nipissing and Huron. Such a direct ship canal, with only a few locks of large lift, would not only save several hundred miles of water navigation, but turn all the ports of Lakes Superior, Michigan, Huron and Erie into what they never will become by the present canals, practical seaports. Had the route lain through the United States, it would unquestionably have been long since under way; and while its cost would certainly be great, its advantages, in extending the Atlantic Ocean to Duluth in almost an air line would be still greater, and its construction at some time in the future may be regarded as certain.

To return to the Nicaragua project, two other dams of about the same cost and magnitude are required for the Tola and Deseado basins, for each of which the rock for a rock fill is much nearer and the water to be discharged over the crest very much less, so that the comparison of a rock fill with a concrete dam would be still more favorable. The only remaining reservoir dams are those to form the San Francisco basin, which, so far, it is proposed to make of earth and puddle.

To do this it is first necessary to clear the ground of a dense growth of matted tropical vegetation, then to excavate the surface soil for a central puddle wall; then to carry up the puddle wall and side embankments in carefully rammed layers in the usual way. No water must pass over the crest, and consequently separate drainage tunnels with gates and waste-weirs are required. When it is all done the work is not absolutely trustworthy especially when built with such labor as must be used at Nicaragua. The least unfaithfulness may give a chance for a leak, and the slightest leak may so enlarge as to ruin the whole work. That these difficulties can eventually be overcome, and permanency secured, is proved by experience, but that they may be overcome only after a series of costly breaks and failures is also proved by experience.

On the other hand, to make these reservoir dams by rock fills, no clearing of the ground or excavating to solid bottom is necessary. The matted vegetation is just what is required to ensure sealing; and after the dam is partially formed the discharge of water over the crest, in floods at least, will be sufficient to wash away all treacherous material from the outer toe of the dam, which is the only place where it is likely to cause trouble. No total giving way of any part of the embankment is to be feared. Estimates for this part of the work on the revised route of 1888 have not yet been prepared in detail, but it is certain to exceed somewhat the aggregate for the single long and high embankment estimated for in the 1885 report, as follows:

ESTIMATED COST OF AN EARTH AND PUDDLE EMBANKMENT ACROSS VALLEY OF RIO SAN FRANCISCO.

[Extreme dimensions, 6,500 ft. long and 51 ft. high. Central puddle wall, 48 ft. on base, 20 ft. on top.]

Clearing ground, 71 acres, at $150	$ 10,650
1,359,456 cu. yds. embankment, rammed in 9-in. layers, at 50 cts.	679,727
329,280 cu. yds. excavation for puddle wall, etc. at 30 cts.	298,784
393,078 cu. yds. puddle, at 75 cts.	94,808
80,556 cu. yds. stone revetment, at $2	161,112
5,236 cu. yds. excavation in drainage tunnel (800 ft. long by 15 ft. diameter) at $5, to discharge floods of Rio San Francisco	26,180
Gates for tunnel	10,000
Waste wier	50,000
Total	$1,333,262
Add for contingencies, 25 per cent.	442,815
Total estimated cost of embankment and appurtenances	$1,874,077

This estimate is certainly none too large; in fact, it is in some of the items quite certainly too small; as for example in the clearing, which it does not seem at all likely can be done for $150 per acre. The comparative estimate for rock is of course greatly reduced by the fact that the rock does not have to be excavated expressly for the work, but can be had for nothing loaded in cars, since it must be so loaded, and wasted in any case. But with this advantage conceded, a very liberal estimate for the cost of the rock fill dam would be the following:

ROUGH COMPARATIVE ESTIMATE FOR A ROCK FILL RESERVOIR DAM ACROSS RIO SAN FRANCISCO VALLEY.

1,359,456 cu. yds. rock fill embankment (2 to 1 slopes) in place of rammed earth, at cost of hauling 4 miles and dumping only, delivered f. o. b. on cars, say 30 cts.	$407,837
329,280 cu. yds. earth fill in place of puddle wall at cost of hauling as above.	98,784
500,000 cu. yds. additional earth filling, if needed to ensure sufficient tightness, at cost of hauling or from adjacent borrow-pits say at 30 cts.	150,000
Total	$656,621
Add for contingencies 25 per cent.	164,155
Total cost for rock fill dam	$820,776
As against, for earth and puddle dam	1,874,077
Saving (56 per cent.)	$1,053,301

These estimates seem to indicate, and we believe correctly, that a saving of $6,000,000 to $8,000,000 in the item of dams alone, can be effected in the cost of the Nicaragua canal by the adoption of a type of construction which is not only cheaper but better at the same cost under the existing conditions. It is largely this fact which leads us to believe, as we certainly do believe, that the Nicaragua canal can and will be built for about the estimated cost of $64,000,000 (including 25 per cent. for contingencies, but nothing for interest charge during construction) despite the fact that some of the work may well cost considerably more than is estimated.

De Lesseps and the Panama Canal.

In his report at the Panama Canal Company's meeting, of August 2, M. DE LESSEPS denounces what he terms the disgraceful manœuvres to accomplish the company's ruin, and begs his countrymen to come to the relief of the company by taking up the lottery bonds. With this item comes the further news that M. GOIRAND, Deputy from Deux-Sevres, announced in the French Chamber of Deputies, on July 18 last, that after 15 days search, in the attempt to learn how the Panama Company proposed to fulfill the conditions imposed upon it by the law regulating its issue of lottery bonds, he had become convinced that up to that time not a single one of the sureties, or *rentes* guaranteed by the State, had been bought by the company.

Unfortunately for M. DE LESSEPS, who has the sympathy of many other than Frenchmen in his present battle with fate, the imminent ruin of the Panama Company and wreck of the canal enterprise is not so much the result of outside influence as it is the extravagant mismanagement of the company itself, the haphazard methods of going to work, and greater physical and sanitary obstacles to success than its too sanguine promoters had dreamed of. These evils, combined with peculiar methods of administration in Paris, that have cost the bond and share-holders vast sums of money, have really brought about the present financial distress. And, in the opinion of the outer world generally, the lottery scheme is not going to galvanize the project into life again; especially, in the face of such remarks in the French Chamber of Deputies as we record above.

The *rentes* referred to were to be purchased by the Company as a security to investors in the lottery loan; in fact, the chief inducement held out to purchasers was that capital was secured outside of the Company's treasury sufficient to meet the demands of the annual drawing promised, and it was on this gambling feature that less than one-half of the desired loan was secured. The promise of the company is just as binding upon it with part of the loan in hand as if the whole had been subscribed; and that they have as yet made no demonstration in the direction of securing the first half of the investors, is not a report likely to attract further investment in the Company's paper.

Had M. de LESSEPS remained content with the prestige of his really great work at Suez, all would have been well with him. But in an evil day and in his old age he consented to lend this prestige to the new and very different canal enterprise at Panama, and doubtless entered into that project with the honest belief that the name made powerful in France by previous success would carry through any difficulty the American scheme. He was not an engineer, as he himself has more than once declared; but he was a diplomat, a man of most sanguine temperament and unbounded vigor, notwithstanding his years. He believed the reports of his engineers as they came to him, without the personal technical knowledge required to digest or disprove them; and on this sandy foundation he erected a vast structure of promises. He imparted to hundreds of thousands of his countrymen, much of his own enthusiasm, and money flowed into the company's coffers in a stream so ample that the executive department at once proceeded to spend it without stint; not in first carefully investigating the real and very formidable problems presented to them on the Isthmus, but in extravagantly conceived harbors, docks, shops, headquarters, hospitals and plant of every untried and useless description. Not but that much of this preliminary work, or work of this character, was necessary in so great an enterprise; but it would have been a wiser and more honest course to have "first caught the hare" and to have found out in all its details the character of the real task. The world heard much for the first few years of the preparations being made; but of the mountain to be cut through at Culebra, of the barrage at Gamboa and of the plans for conducting the excavations and even of the details of survey, other than a center-line, all information was very scanty and imperfect. Meanwhile millions were being expended and an enormous interest account was run up both by the agents on the work and by the administration in Paris.

All went well as long as the money lasted, and the cry was that the canal would be open to the world's traffic in 1887, then in 1888, and finally in 1890. But the pinch came; more capital was needed; and the company had nothing but a progress profile that practically showed merely a scratching up of the surface across the Isthmus; a record so very telling in its story of wasted effort and treasure that every means was taken to suppress it after it had been prepared. Even Frenchmen began to doubt the ability of *le grand Francais* to

save this enterprise from total wreck, and they became more cautious; they would not subscribe on any terms the hundreds of millions yet required to complete the "sea-level" canal. Then, and only then, the company began to economize and proposed to push the opening by a scheme of "temporary locks" that were afterwards to be gradually eliminated when the oceans had been united. This promise of an early "revenue from service performed" failed in itself to attract, and the lottery element was introduced after a scheme to interest the Government of France directly in the project, had failed. The lottery project is now a practical failure, and it seems to be only a question of a few months when the hand-to-mouth existence of to-day must end in a terrible financial crash, such as France has never seen since the days of JOHN LAW.

This is the history in brief of the work at Panama. But there are darker stories afloat in Paris itself, though the French press seems to be so liberally subsidized that hostile expressions of opinion have little chance of publication. It is hinted, and we give them only as hints and not facts, that members of a powerful ring in Paris have amassed great fortunes by trading on their inside knowledge of affairs on the Isthmus; that the stock of the Company has been cornered, and that it is put up or down to meet the wishes and the purposes of the manipulators; that that brave and betrayed old Frenchman, DE LESSEPS himself, is being used as a decoy and a scapegoat by some of his nearest friends for stock-jobbing schemes in which he has no financial interests. These are sad rumors; and if they are false, the Company must blame itself for their existence in the extravagant and unbusinesslike course it has run.

That DE LESSEPS should plead with his countrymen to come to his aid is but natural. He, personally, has staked a reputation gained by a long life of good works, and has persuaded hundreds of thousands of his countrymen to invest their little savings on the faith of his name alone. DE LESSEPS has been the one central figure in all this scheme, the only individual who has appeared in it to the world, and on his head will fall the curses of a betrayed multitude when the inevitable crash does come. The men who may have betrayed him, who have used his good name for more or less dishonest purposes, and wasted the money his prestige has attracted to their treasury, will practically escape public censure, for the people know them not, and it was not on their reputation or fame that the investment was made.

It is not strange then that DE LESSEPS should still battle with his fate and hope when hope is lost. He will not, can not with his experience and temperament, believe himself beaten. He may be blind to the actions of others; too confiding in the reports of his friends; too sanguine of his own power, or foolish in his years; but we will still believe him honest in intention in spite of his present attitude of inviting further investment in a maelstrom of shattered hopes and broken promises.

The Stone Ceiling of the Assembly Chamber of the Capitol at Albany, N. Y.

Owing to the considerable and somewhat conflicting controversy on the stone groined ceiling of the Assembly Chamber in the State Capitol at Albany, we have collated the following facts in the case, and preface them with a short history of the building itself:

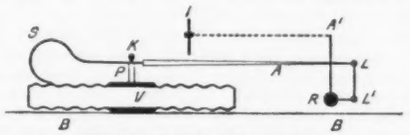
The new Capitol building was commenced in July, 1869; it covers 3¾ acres and is not yet completed. The main building is 300×400 ft. in area and the walls are 108 ft. high above the water-table. The central court is 137×92 ft., and the Assembly Chamber is 84×140 ft. The building has already cost in round figures about $17,000,000, and it is estimated that $5,000,000 more will be required to complete it. As long ago as 1882, Gov. CORNELL appointed a commission, consisting of Messrs. W. P. TROWBRIDGE, CHARLES BABCOCK and GEORGE B. POST, to thoroughly examine and report upon the ceiling of the Assembly Chamber, a stone groined structure of unusual span and weight and which was then showing signs of failure from unequal settlement of the foundations. This committee, while applauding the detail of the design, stated that it was an error of judgment to erect it under existing conditions, and recommended that it be taken down. Previous to the action of this commission, the capitol commission had employed the Hon. WM. H. SLINGERLAND, a civil engineer of Albany, to examine this ceiling; he had reported it as dangerous, and upon his report the commission mentioned was appointed. The outcome of these reports was a vigorous dispute between these gentlemen and Mr. EIDLITZ the original architect, who finally volunteered to put this ceiling in perfect shape at his own expense and was permitted to make the attempt. Mr. EIDLITZ, in Jan., 1883, finished his task and pronounced the ceiling safe again.

Nothing more was practically done to the structure until last winter, when the condition of affairs became too delicate even for the nerves of a New York Assemblyman, and an act was passed by the Legislature condemning the ceiling and ordering it to be removed and replaced by one of wood and iron. The contract for this work has been let and is in process of being carried out. It should be mentioned that the Assembly had appointed Mr. SLINGERLAND to again make an examination and reported on March 24, 1887, that the ceiling was in "a very dangerous condition."

The present work is being conducted under a commission made up of the State Engineer, Mr. JOHN BOGART, Architect UPJOHN and Mr. T. C. CLARKE, Civil Engineer. This commission, on careful examination, condemned the stone ceiling in the most unqualified terms as very dangerous, and very practically confirmed the several reports of Mr. SLINGERLAND, who had been frequently assailed for his long condemnation of this architectural blunder.

Aneroid Barometer.

The sectional view of an aneroid barometer here given was originally prepared for the article on this subject in our last issue. It was unfortunately mislaid, but is now published as better illustrating the text and the more approved instrument of this character than the old-fashioned section printed with the article referred to.



Section, Aneroid Barometer.

IN the case of G. W. HUNT vs. the Oregon Pacific Railroad Company, in the United States circuit court, Judge DEADY allowed a motion to strike out parts of the amended complaint. One part struck out was the allegation that defendant had represented that it had $2,000,000 in its treasury and a large amount of rails paid for, when in fact it had only a comparatively small sum of money and no rails at all. The court held that as the suit was brought to recover damages for a breach of contract, the damages consisted in not being paid, and not in any misrepresentations made by the company. The other portion allowed to be stricken out was the assertion that the engineer who measured the work done, made fraudulent estimates. It was held that this had nothing to do with the action for damages for breach of contract. But if defendants were to set up that it was indebted to plaintiff only half what he claims and base their statement on the estimates of the engineer, plaintiff then might reply that the estimates were false and fraudulent.—Portland *Oregonian*.

WE see that our enterprising cabmen follow the north side cable cars around in the expectation that the cable will break and that they will get custom. This expectation is invariably fulfilled. The cabmen have thrived since YERKES began to operate his big burlesque on rapid transit. You don't hear them complaining about the inefficiency of the cable service.—*Chicago News*.

Canal Methods at Panama.

Dr. WOLFORD NELSON, in a late letter to the Montreal *Gazette*, to which he has been a frequent contributor from Panama, makes even a more dismal showing of present conditions on the canal than did our "Engineer" correspondent of July 28.

Dr. NELSON says that about 5 years ago a huge space was cleared in the jungle at Tavernilla, tracks laid down there and then filled with expensive machinery of all kinds. In 1885 this plant still stood there unused, and in 1886 the tropical vegetation had regained its own and had hidden the machinery from sight—but it was still there. It was machinery purchased on its sand-digging reputation at Suez, but was not adapted to service at Panama, as was discovered after it had been bought and shipped to Panama at an expense "of $10 per ton," for freightage alone. It is little wonder that the Canal Company credits itself with $30,000,000 on the machinery account.

Dr. NELSON goes on to follow this description of one of the machinery graveyards, for there is more than one, with a picture of the marine graveyard; where steam tugs and launches and barges and boats lie submerged and useless.

With $200,000,000 expended; fixed annual charges of over $20,000,000, and after 7 years' work, about one-fifth of the canal is completed. Now come the "temporary locks" at a cost of $1,000,000 each for 10 locks. Dr. NELSON says of these that the engineers on the ground openly ridicule an opening of the canal on Feb. 3, 1890, or for 5 years thereafter, even with locks. And at the time of his last visit no definite plan had yet been settled upon for the great dam that was to feed the upper level of this lock canal.

Dr. NELSON points out the very improbable insurance by reputable marine underwriters of any vessel that had to pass "through pockets of water hung up on the slippery sides of the Culebra," while the engineers were cutting alongside the locks in the deepening project. It is very improbable either that underwriters would insure or a sane captain take a ship into any box of this kind. But the work has not reached that stage yet, and under the past policy of the Canal administration, "sufficient for the day is the evil thereof."

Frenchmen have proved themselves able engineers, but this "deepening" of the canal during traffic is a thing which we do not think even they will attempt. This deepening promise can be classed with that other promise to open the canal on Feb. 3, 1890; or with the rumor here floating about that some of the French excavators on the canal were provided with "counters," and that every revolution of the machine recorded so many cubic metres in the monthly report of "cube extracted" whether the buckets came up full, half-full or empty. The latter device, however, would have some merit in swelling a contractor's estimates, or in showing "rapid progress" in a monthly bulletin.

PERSONAL.

H. C. POTTER, of East Saginaw, Mich., General Manager of the Flint & Pere Marquette R. R., has resigned.

Judge STEVENSON BURKE has been elected President of the Cleveland & Mahoning Valley R. R., which is leased to the New York, Pennsylvania & Ohio.

G. W. SANBORN, Superintendent of the Iowa & Dakota division of the Chicago, Milwaukee & St. Paul, has accepted the position of Superintendent of the California Southern, a part of the Atchison, Topeka & Santa Fé system.

T. A. PHILLIPS has been appointed Superintendent of the East Tennessee, Virginia & Georgia R. R., with headquarters at Knoxville, Tenn.

J. H. SETCHEL, Superintendent of the Brooks Locomotive Works, Dunkirk, N. Y., has resigned.

E. D. ANDERSON, formerly Master Mechanic of the Mississippi Valley R. R., has accepted a similar position on the Tennessee Midland.

HERMAN SILVER has been appointed Treasurer of the California Southern R. R., with offices at Los Angeles, Cal.

J. C. KEY, of Monticello, Ga., has been appointed Vice-President of the Covington & Macon R. R. to succeed the late Col. FROBEL.

A. M. TUCKER has been appointed Superintendent of the Mahoning Division of the New York, Pennsylvania & Ohio R. R., to succeed M. O'BRIEN.

HON. EDGAR T. LECHE has been appointed Commissioner of Public Improvements at New Orleans, La., to succeed Gen. G. T. BEAUREGARD, who resigned recently.

FRED. E. KEEP has been appointed Commissioner of Public Works, at Providence, R. I.

FRANK M. WILDER, General Manager of the Safety Heating & Lighting Co., of New York, has been appointed Superintendent of the shops of the United States Rolling Stock Co.

P. J. FLYNN has been appointed Commissioner of the Hawk St. viaduct, at Albany, N. Y.

D. B. ROBINSON, General Manager of the Colorado Midland R. R., has resigned his position.

Col. H. COLBRAN, of the Cincinnati, New Orleans & Texas Pacific R. R. has been appointed Traffic Manager of the Colorado Midland R. R.

WM. STRAY, Superintendent of the Chicago Gas Light & Coke Co., was killed by a falling beam Aug. 1.

W. E. CUNNINGHAM has been appointed Assistant Superintendent of the St. Louis, Keokuk & Northwestern R. R., with headquarters at Keokuk, Ia.

GEORGE L. PERKINS, Treasurer of the Norwich & Worcester R. R., was 100 years old on Aug. 5, and has been in railroad service for 50 years.

J. M. JACKSON has been appointed Resident Engineer in charge of the Grand Tower extension of the St. Louis, Arkansas & Texas system.

H. G. KELLEY, of the same road, has been appointed Resident Engineer in charge of work pertaining to maintenance on lines in operation, with office at Texarkana, Tex.

JOHN STERLING DEANS, Engineer of the Phœnix Bridge Co., will be in Cincinnati, O., for several months, during the erection of the large railway and highway bridge over the Ohio river.

J. F. HINCKLEY, Chief Engineer of the St. Louis, Arkansas & Texas system, has resigned his position, and will go abroad. Gen. Superintendent H. G. FLEMING will add the work of the Chief Engineer to his other duties.

W. C. VAN HORNE was elected President of the Canadian Pacific Railway Co., at the meeting of the directors on August 7, to succeed Sir GEO. STEPHEN, whose resignation was accepted. Mr. VAN HORNE has a well earned reputation as one of the most competent railway managers in the country. His election to the office of President is another example of the tendency nowadays to place railway men instead of stock operators at the head of the great railway systems.

T. D. KLINE, Superintendent of the Montgomery & Eufaula division of the Central Railroad of Georgia, has resigned his position and accepted the superintendency of the Mexican National. His successor is Maj. A. C. KNAPP

State Control of Railway Tariffs.

The recent decision of Judge BREWER in the case of the Chicago, Rock Island & Pacific Railroad Company and others *vs.* the Iowa State Railway Commission, bears upon the most important matter now being agitated in the railway world. It is fortunate that the upholding of the principle of constitutional liberty which prohibits the taking of private property for public use without due compensation to the owner, can safely be left to our judicial tribunals.

The following abstract of Judge BREWER'S opinion is taken from the Kansas City *Times*.

The first question considered was this: Whether a suit against the railroad commissioners to enjoin them from putting in force a schedule of rates was a suit against the State within the purview of the eleventh amendment, and therefore one of which the Federal Court could not take jurisdiction. Chief Justice MARSHALL had ruled that unless the State was named as a party it was not a suit against the State, but the Supreme Court in 123 U. S., case of in re Ayres, adopted a more liberal view and held that if, although not named in the record, the State be the real party in interest, the one against whom the judgment will operate, it is to be considered as a suit against the State. Applying that rule the judge holds that the State is not a party to this suit; that it is not the real party in interest, the one to be affected by the judgment and upon whom it will operate, the real parties being the railroad companies on one side and the shippers on the other, and that the State has only that remote interest which springs from the general welfare of the people.

The next question considered was this: Can the legislature delegate power to fix rates to a railroad commission, no such commission being recognized by the Constitution? The Supreme Court has held that the power to fix rates is a legislative power, and it is generally true that the legislature cannot delegate its powers to another body. Notwithstanding this, the judge declines to hold that the delegation is unconstitutional for several reasons, the principal ones being these: An act will not be declared unconstitutional unless clearly so. There is no inherent vice in delegating such power to a commission, the vital question being with both carrier and shipper that the rates prescribed be fair and reasonable, and not by what body they shall be put in force. It is a question for the final determination of the Supreme Court of the State, and therefore the Federal Courts should not anticipate its decision. Courts of sister States have sustained similar delegations of power, and therefore there is a probability that this will be sustained by the Supreme Court of Iowa.

The third principal question is whether the legislature has unlimited power in the matter of fixing rates either by its own action or through the agency of a railroad commission, and this question is answered in the negative. The judge holds that the legislature cannot fix rates so low as not to furnish some compensation to the railroad company and compensation to the owners implies revenue sufficient to meet—first the cost of service; second, the fixed charges by way of interest, and third, something, however small, in the way of dividend. He further holds that while, from the volume of testimony offered upon this application, it is not clearly established that the schedule prepared by defendants will fail of producing compensation, yet there is a probability that it will, and therefore a preliminary injunction is appropriate until there can be a full and final inquiry. In reference to the publication of notice and the going into effect of the schedule, he holds that whatever might be the case as to other railroad companies the four companies who had responded with the board have a right to insist that no publication was complete, no schedule in force at the time the restraining order was served. Hence this complainant is not too late with its application and a preliminary injunction is ordered.

Mississippi River Levee Commission.

From advance sheets of the report of WM. STARLING, Chief Engineer, the following abstract gives about the condition of affairs from Jan. 1 to July 1, 1888:—

Since the great floods of 1882 and 1884 more than $1,000,000 has been expended on the construction and repairs of levees by the Upper District of Mississippi, in completing an almost impregnable system for the northern portion of the Yazoo front. Since July 1, 1882, the Greenville District has expended, in conjunction with the U. S. Government, nearly $2,500,000 in similar work. On the west bank of the river the United States, Tensas Levee, District of Louisiana, and local authorities have constructed, or are constructing, levees to the value of about $400,000 in Arkansas alone. In Louisiana, above Vicksburg, the Mississippi River Commission alone has expended nearly $550,000; and to this must be added an unknown amount appropriated by the State and local organizations. Altogether not less than $5,000,000 have been invested, since 1882, in the construction and repairs of levees between Memphis and Vicksburg.

The work of the Mississippi River Levee Commission has been mainly on that going on opposite Greenville. There were in 1884, from Amos Bayou to the Louisiana line, more than 20 miles of large breaks and numerous small ones. These passed in 1884 about 400,000 cu. ft. of water per second; or about one-fifth of the extreme high-water discharge of the river. The flood of 1888 was looked forward to as a test of the work done, and as affording data under complete confinement of the river in flood and under conditions not heretofore attainable. The high-water of 1888 was a moderate flood, but at some points reached a height fully equal to the greatest on record; unless 1862 was an exception, for accurate and reliable data for that year are wanting. Careful observations made upon this 1882 flood convince the Commission that while the upper levees are high enough, those lower down will have to be raised nearly 2 ft.

During the last summer a complete line of levels was run over the entire district and new profiles and estimates have been made upon these. These estimates for new work are not presented with the report because they exceed the resources of the Commission, and unless the Mississippi River Commission assists in carrying them out, they must be very considerably reduced. For this reason it is recommended that no work be advertised until some action is taken by the national board referred to. The cash receipts for the half-year were $336,101.70; of which amount $27,216.13 remains unexpended. The engineering expenses for the two years commencing July 1, 1886, have only amounted to $19,839.15.

The Steamship "City of New York."

This new Inman and International Atlantic steamship arrived in our harbor this week on her first trip across the ocean. As the very latest embodiment of the modern ocean racer this ship has an interest to all, and the following general description is condensed from the London *Engineer*:

She was built by Messrs. J. & G. THOMSON, on the Clyde; and on her trial trip around Ireland on July 21, she developed a speed of 20 knots with 19,000 indicated horse-power and about 12,000 tons displacement. She is 565 ft. long over all; 63½ ft. broad and 42 ft. deep—moulded—and her gross tonnage is 10,500 tons. She has 5 decks and accommodations for 2,000 passengers.

The fittings and internal arrangements of the "City of New York" differ from other ocean steamers. The main saloon has an opening above it covered by a semi-circular stained-glass roof, 33 ft. long by 25 ft. span, placed inside an external roof of steel plate with stout glass in it. The deck promenade is 18 ft. wide and the ship's boats are 8 ft. above the deck so as not to interfere with walking. On the promenade and upper decks are 14 suites of apartments, with parlors and private bath rooms. On the main and lower decks are state rooms for 479 first-class passengers. The first-class smoking-room is 45 ft. long by 27 ft. broad; can seat 130 gentlemen, and is provided with an elaborate and extensive bar. This smoking-room is on the upper deck, after end. The second-class dining-room is 27 × 40 ft. and will seat 150 passengers. There are also 96 second-class state-rooms, in the after end of the main and saloon decks, capable of holding 390 people of this class.

The "City of New York" is the largest carrying vessel now afloat. She is 2,500 tons larger than the "Servia"; 2,732 tons larger than the "Etruria", and 2,340 tons larger than the "City of Rome". A complete electrical plant is used in lighting the ship, with 5 engines and dynamos. The engines propelling the twin screws, 22 ft. diameter and 28 ft. pitch, are two of the largest sets of triple expansion machines afloat. They are of the inverted vertical type, with cylinders of 45 in., 74 in., 113 in. diam. and 4 ft. stroke. There are 54 furnaces disposed in 9 double-ended boilers, with 1,250 sq. ft. of grate surface. This boiler capacity is less than in the "Etruria" or "Umbria"; and yet, thanks to the triple-expansion engine, she is expected to be faster than either.

Brick for Street Paving.

This subject has been agitated considerably at Nashville, Tenn., recently, where many of the streets have been paved with creosoted, or bituminized brick. The advantages claimed for this process are that it makes every brick alike, the softer portions absorbing more and the harder less of the hot material; that it toughens them; and that it makes them absolutely water proof. Brick treated in this way have withstood severe traffic in Nashville for 3½ years and are still in excellent condition. The cost of brick thus prepared is, however, more than double the cost of ordinary brick, and the question whether common brick could not be successfully used for paving has received a good deal of attention. In Ohio, West Virginia and Illinois, streets paved with ordinary brick are said to be still in good condition after six years of steady wear. Specially burned paving bricks are also prepared by some firms, which are extremely hard and have given satisfaction where tried. After the streets have been graded and thoroughly rolled, a layer of 2 or 3 ins. of coarse gravel is put down, and then a couple of inches of fine sand. On this the brick are set on edge with joints broken, the interstices are filled with fine sand and the work is done.

CORRESPONDENCE.

Destructive Force of Colliding Trains.

SCRANTON, Pa., Aug. 6, 1888.

EDITOR ENGINEERING NEWS:

Pending the return of your "Collision Editor" from his vacation, will you permit me to make an addendum, and, to some extent, a correction to my

communication of last week which will render it, I think, more worthy of his consideration.

An examination of the formulæ which I give therein shows, I think, what I failed to call attention to at the time, that the colliding trains of equal weights and velocities, so far from having less destructive capacity than if one were stationary and the other actuated with a velocity equal to the total relative velocity (or even an equal destructive capacity to this), would have one actually greater.

I think that the true enunciation of the proportion is: If two bodies of equal weight and velocity collide upon the same trajectory, the shock is the same as would be produced were one supposed to be *immovable*, and the other moving with double its actual velocity.

My reason for so thinking is, that in this case, the two bodies would come to a stop after colliding; while if one was stationary, and the other striking it with the same relative velocity, both bodies would, theoretically, move onward.

I trust my remarks upon this subject will call for a more complete elucidation of it from some of your readers who are qualified to treat it more thoroughly than I have done. G.

Mineral Wool and Pipe-Freezing.

NEW YORK, Aug. 8, 1888.

EDITOR ENGINEERING NEWS:

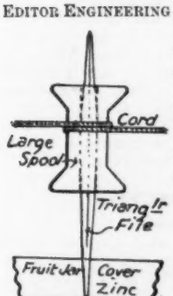
In looking over your paper of Aug. 4, I see an inquiry from G. F. C., Taunton, Mass., for a packing to keep water pipes from freezing Last winter, at Batavia, N. Y., we took a quart bottle of water and put it in a section of our mineral wool covering, and closed the ends with mineral wool. The bottle thus protected was put out of doors, on a fence, over night. The thermometer fell 2° below zero during that night, and when we examined the bottle in the morning not a particle of ice was to be found in it. This covering will doubtless answer his purpose.

Yours truly, JOHN RANKEN.
U. S. Mineral Wool Co.

A Simple Breast Drill.

TOPEKA, Kan., July 25, 1888.

EDITOR ENGINEERING NEWS:



I send a sketch of a simple breast drill, which may be useful to such of the profession as are "handy with tools".

If you think "It fills a long felt want", I should be pleased to see it appear in the NEWS. Yours truly,

GORDON DINSMOOR.

[This is one of those handy applications of things at hand that may serve a useful purpose, and it is published accordingly We would suggest the addition of a round thin block of wood inside the "fruit jar cover" to prevent the drill end from slipping on the smooth porcelain.—ED. ENG. NEWS.

Protecting Pipe From Freezing.

NEW YORK, Aug. 6, 1888.

EDITOR ENGINEERING NEWS:

In answer to your correspondent "G. F. C." in your issue of Aug. 4, would say that I carried a line of 5-in. pipe over three railroad bridges last fall. When put in position I wrapped each one with thick paper, and then put on a ¾-in. cover of felt, then over that another paper wrapping, then on that another ¾-in. felting, and over that another paper wrapping.

I then built a box around the pipe and filled it with sawdust, there was no circulation of water through these pipes as there were no consumers on the other side of the bridges.

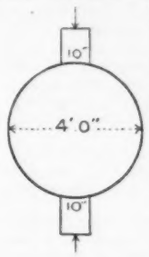
My experiment was entirely successful, there being no signs of freezing, although, according to the oldest inhabitants, the weather was the most severe experienced in the last 30 years. Respectfully.

JOHN LOCKWOOD.
Hydraulic Engineer.

A Grindstone Problem.

FRASERVILLE, Que., Aug. 2, 1888.

EDITOR ENGINEERING NEWS.—The following problem I find somewhat troublesome. I have a solution, but am not satisfied with it, and would feel obliged for more light, either from yourself or your readers.



Given a grindstone 4 ft. in diameter by 28 in. face, weighing 4350 lbs., revolving on a 6½ in. horizontal shaft, at the rate of 250 revolutions per minute. On each side of the stone are presses, pressing an area of 270 sq. in. with a total pressure in each press of 7634 lbs.

Required, 1st., The horse power requisite to drive the stone?

2d. Does the pressure have a tendency to increase the rupture of the stone, or does it in part re-act against the tendency of the centrifugal force.

3d. What is the section to be taken into consideration when figuring against rupture by centrifugal force, and is it tension or compression on the stone at the moment of rupture?

4th. What is the highest velocity that it would be safe to give the stone, under the above conditions?

The stone is strong, compact, German sandstone, composed of small crystals of almost pure silica, is white in color, and very close in texture.

Yours truly,

M. J. B.

PUBLICATIONS RECEIVED.

THE fourth article in the Railway Series now appearing in *Scribner's Magazine*, will be contributed to the September number by GEN. HORACE PORTER, who writes of "Railway Passenger Travel," giving much entertaining information in regard to the origin and development of sleeping, parlor and dining cars, and vestibuled trains. Gen. PORTER's narrative is enriched by his usual faculty of bringing out the most interesting and striking features of the subject. He will also touch upon the question of car couplers, steam-heating, switches, checks, immigrant transportation, and ratio of accidents.

An Index to Engineering Periodicals, 1883 to 1887, inclusive. Comprising Engineering; Railroads; Science; Manufactures and Trade. By FRANCIS E. GALLOUPE, M. E., Mass. Inst. of Technology; Mem. Am. Soc. Mech. Eng's. Boston and New York. Engineering News Publishing Co., publishers, 1888. Size 8 x 5¼ in. pp. 294, Price $2.

We have already announced the coming of this work and its purpose, and can only add that Mr. GALLOUPE has done his work well, and very well when the magnitude of the task is considered. We have new ideas and novel methods thrust upon us at such a rapid rate in the present day that text-books of any character can not keep pace with their issue. Periodical technical journals with their weekly or monthly issues are the only publications in which the mass of this new matter is to be found, and to keep posted in the almost daily progress of the sciences in this rapid age the student is compelled to depend upon the periodical devoted to his particular pursuit. But the very fact that they treat of the new things as they appear and of many different things in the same issue, requires considerable knowledge of these various journals, and research in past issues when any one particular object is being sought. To assist in this otherwise somewhat irksome labor is the purpose of this Index; to classify the contents of the various leading journals and to point out under one head the various important contributions on any new topic. The contents of this book are alphabetically arranged and cover about 10,000 references as taken from some 150 different indices. Engineers and the various professions and pursuits must appreciate the laborious task of the author of this Index, who has worked that others may be saved labor and valuable time.

Indiana Society of Civil Engineers and Surveyors. Proceedings of the Eighth Annual Meeting, held at Indianapolis, Ind., Jan. 17, 18, 19, 1888. This volume contains the reports of committees, the most interesting of which are those of the Drainage Committee, and the Committee on Statistics, the latter containing answers from the different counties to the following questions: Name and address of county surveyor; ditch work of the past year; cost of same per cu. yd.; which drainage act is used; any large or difficult jobs; suggestions as to drainage acts; gravel road or common road laws; gravel road work of the past year; bridge work; does the county furnish instruments, office, stationery, etc.; any new railroad. There are also the following papers: "Topography", A. E. PHILLIPS; "Topography by Photography," L. S ALTER, Remington; "Brick," JACOB NORRIS, Crawfordsville; "Instructions for Surveys in Indiana in 1815," P. J. MORRISON; "Economy in Road Construction", W. B. HENNING, Waterloo; "Astronomy for Surveyors", Prof. C. A. HARGRAVE, Danville Normal College; "Bridge Specifications", W. S. FRIES, Greenfield.

Arkansas Society of Engineers, Architects & Surveyors.—Transactions, vol. 1, Nov. 1887; 74 pp.; 50 cts. Published by the Society, at Little Rock, Ark.

This first volume of one of the most recent of the technical societies contains the constitution, list of members, transactions of the first annual meeting, at Little Rock, in November, and the following papers: "Waring's System of Sewerage", J. H. HANEY, Little Rock; "Municipal Engineering in Arkansas", FRED. J. H. RICKON, Little Rock; "Engineering Education", J. M. WHITHAM, Fayetteville; "Legislation Necessary to Advance the Profession," B. S. WISE, Surveyor of White Co.; "The Aims of the Society and the Legislation Necessary for the good of the Profession and the State", A. B. MATSON, City Eng., Texarkana; "Limes & Hydraulic Cement", F. W. GIBB, Little Rock; "Decimal vs. Metric System for American Engineers", J. P. BATES; "Improvement of the Arkansas River", Capt. H. S. TABER, U. S. Engs.; "Sanitation", B. J. BARTLETT, Little Rock; "New Croton Aqueduct", LEE TREADWELL, Fayetteville.

Illinois Society of Engineers & Surveyors.—Report of the Third Annual Meeting, held at Springfield, Ill., Jan. 25, 26, 27, 1888. 156 pp. Price, 50 cts.

This volume contains the proceedings of the meeting, the President's address, the committee reports, and the text of a bill to provide for the examination and appointment of licensed surveyors. There are also the following papers "A Railroad Culvert", (illustrated), EDWIN A. HILL, Indianapolis, Ind.; "Hygienic Engineering and Architecture", Dr. GEO. N. KREIDER, Springfield; "The Interest of Engineers and Contractors in Improved Highway Bridges", J. H. BURNHAM, Bloomington; "Specifications for Bridge Iron", Prof. I. O. BAKER, Champaign; "Coal Fields of Colorado and New Mexico", A. C. BRAUCHER, Canon City, Col.; "Highway Bridges", J. O. WRIGHT, Lafayette, Ind.; "Bridges and Viaducts for Cities, their Selection and Maintenance", D. W. MEAD, Rockford; "Surveying,—Practical and Artistic", D. L. BRAUCHER, Lincoln; "Replacement of Wooden Trestles with Iron and Stone Structures", J. M. HEALEY, Champaign; "Ohio River Bridge at Cairo", S. F. BALCOM, Champaign; "Laying out Towns, and the Value of Proper Monuments", T. S. MCCLANAHAN, Monmouth; "Note on Magnetic Declination as Dependent upon the Instrument", Prof. I. O. BAKER, Champaign; "The True Exterior Boundary of Townships", Z. A. ENOS, Springfield; "Rockford, Ill.", (map), D. W. MEAD, Rockford; "Artesian Wells", T. B. COMSTOCK, Champaign.

SOCIETY PROCEEDINGS.

Engineers' Club of Kansas City.—An excursion to Leavenworth, Kan., was taken July 28, by 27 members and 42 guests. The party had a special train, and visited the Soldiers' Home before reaching the city. At Leavenworth, the new Union depot, the water-works, pumping and electric light plant, and the works of the Leavenworth Coal Co. were visited. Pleasant drives were taken and the party had an enjoyable trip.

Southwestern Gas Association.—The first regular meeting will be held at Galveston, Tex., Aug. 20. The following papers will be presented: "Gas Coals on the Texas Markets", by WM. ENFIELD, of Dallas; "The Relation of the Incandescent Electric Light and the Gas Light", by F. BECK, of Galveston; "The Insertion of New Purifying Apparatus", by C. P. RUSSELL, of Houston; "Computation of Cost of Gas, both to Consumer and in Holder", by JOHN L. BROCKENBOROUGH, of Waco; "The Regenerative Gas Lamp", by WM. H. CHRISTIE, of Fort Worth.

Any other papers will be acceptable at the meeting, and the programme will not be confined to the reading of the above named papers. THOS. D. MILLER, *Secretary*, Fort Worth, Tex.

CONSTRUCTION NEWS.

RAILROADS.

East of Chicago.

Existing Roads.

Brockville, Westport & Sault Ste. Marie.—This Canadian line is now open for traffic between Brockville and Westport, Ont., about 50 miles, except the section of 4 miles between Brockville and Lyn, which is being graded. Meanwhile the company uses the Grand Trunk Railway tracks to Lyn. Trains now run regularly over the line and the work of improving the roadbed is continually being carried on; 56-lb. steel rails have been used, and Fisher joints are used throughout.

Except for a considerable number of curves the location is good. There are no steep grades and the embankments are low and the cuts shallow. It has been found necessary to build only one bridge of any size—a steel

plate girder structure of 70 ft. span over the Rideau canal at Newboro.

The character of the region near the present terminus of this line, will probably make it a favorite route for sportsmen and tourists.

Canadian Pacific.—On the extension of the International Railway across northern Maine about 40 miles of track have been laid, leaving about 76 miles to complete. The rock work on the line is about completed, and work is in progress on the bridges at Mattawamkeag, Wilson Stream and Ship Pond.—The company has asked the town of Chatham, Ont., to grant right of way and depot grounds in aid of the extension from London, Ont., to Windsor or Sarnia.—Vice-President and General Manager W. C. VAN HORNE has been elected President to succeed Sir GEORGE STEPHEN.

Grand Trunk.—Negotiations have been started for the sale to the company of the London & Port Stanley Railway, 24 miles in length, which has been operated under lease by the Grand Trunk since 1872. The principal interest in the company is owned by the city of London.

New York & New England.—About 1,500 men are at work on the extension of the New Haven & Derby Railroad, from Derby to Hawleyville, Ct. Grading is completed for 8 miles, and about a half mile of track has been laid.

Montreal & European Short Line.—This company has filed a statement of claims in the Exchequer court at Ottawa against the Dominion Government. The members of the company include Dr. NORVIN GREEN, WM. BOND, F. W. ALLEN, A. Z. BLACKMAN and others of New York. It is claimed that the Dominion Government gave the company the contract for building a railway from Oxford Station to Glasgow with branches to Pugwash and Pictou. The line was taken possession of by the Government on Jan. 28, 1888, while still incomplete. $600,000 damages are claimed.

Port Clinton Short Line.—This Ohio road is nearly graded from Port Clinton to Fremont, about 20 miles. Work on bridge building and tracklaying is to be pushed at once. E. H. BRENNAN, of Port Clinton, is President of the company.

Pennsylvania—It is proposed to remove the grade crossings on the Union R. R. in the northeastern part of the city of Baltimore.

Lehigh Valley.—Surveys are reported in progress for a branch to Pittstown, N. J., about 4 miles in length.

New York, Mahoning & Western.—The injunction secured against this company by the Mahoning Construction Company, to prevent the transfer of the contract to the Allegheny Construction Co. has been dissolved, and work is again in progress. The court has ordered that $400,000 in bonds be issued by the company, the proceeds to be used in paying the debts incurred by the Mahoning Construction Co.

Baltimore & Drum Point.—It is reported that this Maryland company has secured ground for its terminals at Baltimore.

Baltimore & Ohio.—The two mile branch to Guilford, Harford Co., Md., has been located and will be placed under construction at once.

Midland Railway of Indiana.—The recent decision of the Indiana Supreme court on the validity of certain local subsidies which the company had secured, has been a severe blow to this company. Construction work has been suspended on the extension and also on the new shops at Lebanon.

Lake Erie, Alliance & Southern.—It is stated that ANDREW CARNEGIE and his partners have secured control of this railway and propose to extend it from its terminus at Phalanx, O., to the shore of Lake Erie. It is designed to make the line an important factor in the ore carrying trade from the lakes to Pittsburg.

New York, Ontario & Western.—Sealed proposals will be received by the company until Aug. 15 for the construction of the Wharton Valley Ry., from New Berlin to Edmeston, N. Y., 7 miles. E. CANFIELD of Middletown, N. Y., is Chief Engineer.

Chautauqua Lake.—At the annual meeting held at Jamestown, N. Y., Aug. 7, Jos. M. GAZZAM, of Philadelphia was elected President; J. C. WILLIAMS, Cleveland, Vice-President; GEO. H. BURT, Boston, Treasurer; F. G. JEWITT, Jamestown, General Superintendent.

New Projects and Surveys.

Middletown & Hummelstown.—This Pennsylvania company, whose incorporation was reported last week, is to begin work on the surveys for its proposed line at once. JOHN W. RIFE, of Middletown, is President, and C. W. RAYMOND, of Middletown, is Secretary. JAS. Y. CHAMBERLAIN, of Harrisburg, is also interested. The capital stock of the company is $100,000, and the line will be about 6 miles in length.

Evansville, Ft. Wayne & Chicago.—A survey is to be made from Ft. Wayne to Lafayette, Ind., for a line to parallel the Wabash. MILTON SHIRK of Peru, Ind., and JAS. DREW of Indianapolis are interested.

Chicago, Dayton & Cincinnati.—The election at Huntington, Ind., to determine the matter of a subsidy of $49,500 to this project resulted in favor of the subsidy by a majority of 645.

SOUTHERN

Existing Roads.

Louisville, St Louis & Texas.—About 50 miles of track are down on this line between Owensboro and West Point, Ky. Grading on the whole of this division, 91 miles in length, will be completed by Aug. 15, and it is hoped to have the track all laid a month later. The Muskegon Car Works have just completed 150 freight cars for the company, and the passenger equipment is under way in the shops of the Jackson & Sharp Company. The line will enter Louisville over the Chesapeake, Ohio & Southwestern tracks, and will use that line as far as West Point. Work on the bridges between Henderson and Owensboro is making rapid progress.

Eutawville.—R. S. PRINGLE has a grading contract on this South Carolina road from Vance's Ferry ten miles toward Sumter. He has about 150 convicts now at work on the line.

Louisville, New Orleans & Texas.—Work is to begin at once on the construction of the branch in Bolivar County, Miss., from Lamont to Beulah, about 20 miles. Proposals are to be called for very soon for the building of 500 freight cars for the company.

Cape Fear & Yadkin Valley.—The extension from Factory Junction to Millboro, N. C., is to be continued to Troy, Montgomery Co.

Norfolk & Virginia Beach.—This company has filed a mortgage to secure bonds to the amount of $200,000 which it will issue to raise funds for changing the gauge of its line and building the branch to Princess Anne C. H.

Illinois Central.—It is reported that a branch which is now operated as a lumber road will be extended from its terminus at Brookhaven to Monticello, Lawrence county, Miss. The county has been asked for a subscription of $50,000 in aid of the extension.

Richmond & Danville.—Grading will be finished through Red Marble Gap on the Murphy extension of the Western North Carolina railroad in October, and the line is expected to reach Murphy some time next season.

Roanoke & Southern.—F. H. FRIES, of Winston, N. C., President of the Virginia & North Carolina Construction Company, has let the contract for building this road from Winston to Walnut Cove, N. C., to Griffin & Gorton of Yorkville, N. C., who have just completed a contract on the Charleston, Cincinnati & Chicago railroad.

Chattanooga, Rome & Columbus.—It is reported that this company will begin surveys soon on an extension from Carrollton to Columbus, Ga., and thence to Montgomery, Ala. There seems little likelihood, however, that the company will branch off to Montgomery. It is more likely, if it builds on after reaching Columbus, to go to the south or east.

Ripley & Mill Creek Valley.—The Ohio River Railroad Company has decided to endorse the bonds of this West Virginia company, whose line was nearly graded last season from Ripley to the mouth of Mill Creek on the Ohio River, 12¾ miles. Work has been resumed on the line, and it is now expected to complete it by Oct. 15.

Ohio Valley.—Work is to begin at once on the extension to Evansville, Ind. A transfer boat will be used to cross the Ohio river.

Durham & Oxford.—Grading has been finished on this North Carolina railroad.

Chesapeake & Ohio.—The surveys for the extension from Paducah to Cairo, Ky., have been completed, and it is reported that the construction of the extension has been decided upon.

New Projects and Surveys.

Alexandria & Charleston.—

ALEXANDRIA, Va., Aug. 3, 1888.

EDITOR ENGINEERING NEWS:

The Alexandria & Charleston Railway is projected to extend from a connection with the Richmond & Danville system at Strasburg, Va., across the mountains into the coal fields of West Virginia, making Charleston the western terminus. The principal object of the line is to open up the coal, iron and lumber region of West Virginia. The line is to be placed under survey at once. Hon. J. S. BARBOUR is President of the company. No Chief Engineer has been elected. JOHN R. REAVIS *Secretary.*

High Point, Randleman, Asheboro & Southern.—

RANDLEMAN, N. C., Aug. 4, 1888.

EDITOR ENGINEERING NEWS:

This line to run from High Point, N. C., *via* Randleman, Ashboro and Troy. The Richmond & Danville Company are backing the enterprise and will furnish the capital for construction. Right of way is secured, surveys will begin in a few days, and contracts will be let very soon. About 16 miles has been graded. R. P. DICKS, *President.*

Great Western Air Line.—

CHARLOTTE, N. C., Aug. 3, 1888.

EDITOR ENGINEERING NEWS:

The Great Western Air Line Railway is projected to extend from Charlotte, N. C., *via* Albemarle, Ashboro, and Durham to Weldon, N. C., a distance of 206 miles. It is also proposed to build in connection a road to Lancaster, S. C., 30 miles, and another to Yorkville, S. C., a distance of 40 miles. The road has been surveyed from Charlotte northeast to the Randolph county line, a distance of 60 miles. The road is projected in the interest of Charlotte & Mecklenburg county. Right of way can be obtained for the whole distance, and capital for building will be largely secured by county subscriptions. Contracts for construction will probably be let next season.

WALTER BREM.

Statesville Air Line.—

STATESVILLE, N. C., Aug. 4, 1888.

EDITOR ENGINEERING NEWS:—

The Statesville Air Line is projected to extend from Spartanburg, S. C., *via* Shelby, N. C., Lincolnton, Statesville, Moxville, and Winston to Danville, Va., a distance of 150 miles. The line is all surveyed, right of way is being obtained, and capital for construction is partly subscribed by towns along the route. J. J. MOTT is President, and C. A. CARLTON is Secretary and Treasurer.

W. A. ELIASON, *Chief Engineer.*

Greenville & Big Stone Gap.—Incorporated in Tennessee to build a railroad from Greenville to Big Stone Gap, Va., by JAS. H. ROBINSON, A. S. JOHNSON, JOHN B. WHITE and others.

Lebanon & Harrodsburg.—A meeting was held at Perryville, Ky., on Aug. 3, in the interest of this projected line which was chartered in 1887. JOHN B. THOMPSON of Harrodsburg, representing an Eastern syndicate, addressed the meeting and stated that in order to induce Eastern capital to undertake the enterprise it would be necessary for Mercer county to vote $100,000 and Marion, $125,000 in aid of the enterprise. Much doubt was expressed, however, as to the willingness of Marion to subscribe so large a sum. A motion was adopted to appoint a committee to confer with the syndicate and with the people of the counties, and report at a future meeting. The Committee consists of SAMUEL AVERITT, of Marion; W. E. RAY, of Washington; C. T. ARMSTRONG, of Boyle, and JOHN B. THOMPSON, of Mercer.

Selma & Cahaba Valley.—It is reported that arrangements have been made by Pearson, Crocker & Co., the projectors of this Alabama railroad, for the early construction of the line.

Louisville, Hardinsburg & Southwestern.—Chief Engineer JACKMAN has completed the surveys for this Kentucky road from Hartford to Fordsville. The alignment is said to be excellent, and the grades moderate, and maximum grades are only necessary to cross Carter's summit. The line runs mostly in the valleys of Rough Creek and Adams Fork, and intersects the Owensboro and Falls of Rough road 20 miles from Hartford.

Kanawha.—At the next regular session of the County Court of Kanawha it will be asked that an order be made submitting to the voters of that county the question whether the county shall subscribe $300,000 in county bonds, to run 40 years, to aid in the construction of the following railroads: $100,000 for a railroad up Elk River, $33,000 for a railroad up the Kanawha, and $67,000 for a railroad up Coal River. The money is all to be spent within the boundaries of Kanawha County, and the length of the road to be built a little over 70 miles. The landowners all along Twelve Pole are donating land for the proposed railroad up that stream.

The Clarksburg, Weston & Buchanan Railroad, which lost nearly all its bridges in the late flood, is again in running order as far as Weston.—*Cincinnati Enquirer.*

Bowling Green, Hartford & Ohio River.—A company has been formed at Calhoun, McLean county, Ky., under the old charter of the Bowling Green, Hartford & Ohio River Company and proposes to build a railroad from Bowling Green *via* Morgantown, Hartford and Calhoun to Evansville, Ind., crossing the Ohio river at Newburg. A meeting of the parties interested is to be held at Beaver Dam on August 21. W. B. NOE and G. T. CARY, of Calhoun, are at the head of the enterprise.

THE NORTHWEST.

Existing Roads.

Negaunee & Palmer.—

MARQUETTE, Mich., Aug. 4, 1888.

EDITOR ENGINEERING NEWS:—

The Negaunee & Palmer Railroad is to run from Negaunee, Mich., to the Palmer mine, a distance of 6 miles. Grading is completed and tracklaying is in progress. The line is a branch of, and is built in the interest of the Duluth, South Shore & Atlantic Company. Hon. JAS. MCMILLAN is President. J. A. LATCHA, *Chief Engineer.*

Duluth, South Shore & Atlantic.—The election of a new board of directors of this company brings the Canadian Pacific interest in the company in control. The directors representing the Canadian Pacific are Sir GEO. STEPHEN, Sir DONALD A. SMITH, W. E. VAN HORNE, J. W. STERLING, R. J. CROSS and T. W. PEARSELL; JAS. MCMILLAN of Detroit is President, C. S. BRICE and W. C. VAN HORNE, Vice-Presidents.—A number of the hands in the repair shops at Marquette have been discharged, and it is conjectured that the new management will pursue a retrenchment policy.

Illinois Central.—The Chicago, Madison & Northern Railroad has been completed and opened for business from Freeport to Elmhurst, Ill., with E. G. RUSSELL as Superintendent.

St. Paul, Minneapolis & Manitoba.—On the Eastern Railway of Minnesota, which is to run from Hinckley to Duluth, about 25 miles of track are laid and the 20 miles remaining are ready for the rails.

Northern Pacific.—The terms of the contract between the company and the Manitoba Government are substantially the same as stated last week. The Manitoba Government is to complete the Red River Valley and the Portage extension before Nov. 1, and turn them over to the Northern Pacific, which is to pay $720,000 for the first named line, and $400,000 for the other. Within one year from Nov. 1 the company agrees to build a line from Morris to Brandon, 20 miles of which are to be completed this fall. The company guarantees not to

allow its stock to be transferred or sold to any one interested in the Canadian Pacific or St. Paul, Minneapolis & Manitoba, and pooling with any railway is prohibited Running power over the roads will be allowed to all railways excepting the Canadian Pacific and St. Paul, Minneapolis & Manitoba. The roads are exempt from taxation for 20 years or until they more than pay expenses. The Lieut-Governor in Council has the power to fix, regulate and determine all freight rates, and all their tariffs must be approved by the local Government. The Northern Pacific will work in Manitoba under the name of the Northern Pacific & Manitoba, and the company will be incorporated at the forthcoming session of the Legislature. Two of the five directors of the company must be members of the Provincial Government. Tenders have been asked for the line to the Portage, and work on the Red River Valley is being vigorously pushed ahead.

Atchison, Topeka & Santa Fé.—Apropos of the continued reports that the Santa Fé company intends to extend its system into Nebraska, the following, which has been recently published, is of interest:

"ATCHISON, TOPEKA & SANTA FE RAILROAD CO., office of the President, Boston, July 24, 1888. C. E. Perkins, Esq., President C., B. and Q. R. R., Boston, Mass.:—Dear Sir—I have your favor of the 18th inst., stating that aid is being voted in Phelps County, Neb., for an extension of our road from Superior. Such action is without request or authority from our company. Our road terminates at the State line of Kansas, and we have no charter for construction in Nebraska, and do not intend to take out a charter in that State or to build any road within its limits.

Yours very truly
(Signed) WM. B. STRONG, President."

THE SOUTHWEST.

Existing Roads.

St. Louis, Arkansas & Texas.—As noted in our Personal column, Mr. J. M. JACKSON has been appointed Resident Engineer in charge of the extension from Malden to Grand Tower, Mo.

Missouri Pacific.—The Kansas & Arkansas Valley Railway has been completed from Fort Smith, Ark., to Wagoner, Ind. Ter., and will be opened for business Aug. 12. There seems no present prospect of the extension from Wagoner to Arkansas City, Kan., being carried through.

Kansas City & Southern.—The last rail was laid on this Missouri road on Aug. 4, at East Lynne, completing the line from Osceola, Mo., to Kansas City, a distance of 112 miles. The extensions to Hart's Grove and to Bolivar are in progress.

Atchison, Topeka & Santa Fé.—A spur has been completed from Ardmore, Ind. Ter., to coal mines, a distance of three miles.——An interview with General Traffic Manager GODDARD, in the St. Louis *Globe Democrat*, quotes him as of the opinion that little will be done next year in the way of constructing new lines.——It is reported that a branch is soon to be built to Moberly, Mo., from the Chicago, Santa Fé & California line. The branch will develop extensive coal lands near Moberly.

New Projects and Surveys.

Carthage, Pittsburg & Ft. Scott.—A meeting was recently held at Carthage, Mo., relative to the organization of a company to build a railroad from Carthage to the coal fields northwest, for which the above title has suggested, J. P. BETTS of Carthage is interested.

New Orleans Belt.—The New Orleans Chamber of Commerce is still discussing the proposed belt railroad. At its meeting on Aug. 4 a previously appointed committee reported a plan of operation of the proposed belt line.

Grand Isle.—It is reported that a company is being formed to build a railroad from Ewing station, on the Southern Pacific west of New Orleans, to Grand Isle, about 46 miles. JOHN KRANTZ of New Orleans is said to be the prime mover in the scheme.

ROCKY MOUNTAIN & PACIFIC.

Existing Roads.

Oregon Railway & Navigation Company.—Considerable attention is being directed to this company's work by the suit which has been brought by those prominently interested in the company to prevent the completion of its branches now under way, as noted last week. A brief summary of the state of affairs, neglecting the complications, is that an attempt is being made to have the Union Pacific, the Northern Pacific and the Oregon Ry. & Navigation companies all work together harmoniously in the matter of building extensions in eastern Washington Territory, Oregon and Idaho. An agreement to this effect made last spring was hindered from taking effect by an Oregon law, (a disgrace to the statute book) forbidding the leasing of competing lines. Certain parties interested in the Oregon Ry. & Navigation Co., therefore have taken advantage of this delay to push work on several extensions in disregard of the agreement before named. The following very good account of the Oregon Ry. & Navigation system and extensions is condensed from the Portland *Oregonian*.

"At present the Oregon Railway & Navigation Co. have in active operation 751 miles of railway, while there is in course of construction 241 miles of road. Commencing at Portland, the main trunk line extends through to Huntington, a distance of 404.4 miles. Radiating from this are several important branches. From Umatilla a branch extends to Walla Walla, which is distant from Portland 245.3 miles. Commencing at Pendleton a branch extends northward, passing through Walla Walla, and continuing on, reaches the Snake river at Green City. Branching from this line are two short roads, one reaching eastward to Dayton and the other extending east to Pomeroy. There is a very short branch also extending to the east from Green City to Riparia. This branch lies near the south bank of Snake river and extends nearly parallel with that stream. All these branches mentioned lie south of the Snake. North of Snake river are several branches. One line starts at Palouse Junction and reaches to Colfax. From that point one branch extends east to Moscow and another northeastward to Farmington.

The Snake river divides the two branch systems, and between Riparia and Sutton station—the nearest points of approach—is a gap of 25 miles. The distance from Riparia to Sutton, or, as it is generally designated in railroad parlance, the "fifty-third mile post," was graded several years ago when Mr. Villard was at the head of affairs. Recently the Snake was spanned by a bridge, and trains can now cross. This short branch road is now being built by the Oregon Railway & Navigation Company proper, and work is being carried forward with all practicable haste. It is thought that this important link in the chain will be completed in a few weeks and ready for active operation. Its importance in the general branch system controlled by the O. R. & N. Co. is great, for the reason that by building a road from Sutton down to Texas Ferry, (Riparia) the missing link is supplied, and the company has an independent road clear through to Portland. This gap filled, and the necessity is obviated of using that portion of the Northern Pacific Company's main line from Palouse Junction down to Wallula. Heavy tribute has been exacted and paid by the O. R. & N. Co. to the Northern Pacific ever since the completion of the branch road to Palouse Junction, for every bushel of wheat hauled and every pound of freight carried. North of Snake River and south of the Northern Pacific line is one of the great grain belts of the Inland Empire. It embraces one of the richest, most fertile and most productive sections on the North Pacific coast. Through this splendid region the lines of the O. R. & N. Co. extend, commencing at Palouse Junction and terminating at Moscow and Farmington.

This same fertile agricultural belt is tapped by the Northern Pacific by a branch road leaving the trunk line at Marshall, near Spokane Falls, and running southeast to a point not far from Lewiston, Idaho. This branch is about 105 miles long. However, by the completion of the twenty-five mile branch by the O. R. & N. Co. a nearer and more direct route is secured to tidewater than by the other branch. With the three branches now in course of construction a great area of rich country will be tapped and all made tributary to Portland.

These three lines are called respectively the Pleasant Valley branch (forty-eight miles long), Rockford branch (thirty-three miles long) and the Mullan branch (ninety miles long). Strictly speaking, these lines are not being built by the O. R. & N. Co., as that corporation has no charter authorizing them to construct these branches. The Pleasant Valley branch is being built by the Oregon Railway Extension Company. It commences a short distance below Endicott, on the Palouse branch, and extends north and east to a junction with the Rockford line. The Rockford line is being build by the Washington & Idaho Railroad Company. It starts at Farmington and runs north to Rockford. The Mullan branch connects with the Rockford line at Hangman creek and extends almost due east to Mullan. This is the branch which will connect with the Cœur d' Alene mines. It is also being constructed by the Washington & Idaho Railroad Company. Completion of the line to Rockford will leave only a very short gap between that point and Spokane Falls. Twenty-six miles of road will reach that city.

Besides the branches mentioned above—both those in operation and those in process of construction—the O. R. & N. Co. are building another line. This branch leaves the trunk line at the mouth of Willow creek, and extending south, reaches Heppner. The distance is 46½ miles. Work on this line is being pushed rapidly by the contractor and will probably be completed within six weeks.

Southern Pacific.—About 85 miles of track have been laid on the Stockton & Tulare extension and the end of track is now 16 miles beyond Porterville. Work on the Huron line has been abandoned for the present. An extension of 25 miles is proposed from Corvallis to Junction, Ore.

Atchison, Topeka & Santa Fé.—Trains began running Aug. 18 between Los Angeles and San Diego over the Santa Ana short line which has just been completed.——A report is in circulation that the Mexican Pacific enterprise, to which we have frequently referred, has been taken up by the Santa Fé company and will be carried out as an addition to their Sonora system.

San Francisco & Northern Pacific.—An interview with Col. J. M. DONAHUE, President of this California system, as reported in the Portland *Oregonian*, quotes him as follows in regard to the proposed extensions of this line:

"Parties in San Francisco, have offered to bond the road in England in order that more capital might be had, and I have had the same offer in the East, but as to the extension of the road toward Idaho, that is not the immediate object. The desire is to extend the road toward Eureka and go right into the redwood country, where we would find immediate business. Then we might take up an extension toward Idaho, but $3,000,000 would be ample to build that. Some people have had an idea that we would only build over Beckwith pass to the eastern line of California, but we would go through Eastern Oregon into Boise valley. The route is perfectly feasible. There is no need of snowsheds anywhere. It is true that I have had a preliminary survey made, and I will go further and say I have had the route located through all important passes according to law. I made a reconnoissance two years ago, before the Chicago & Northwestern or any other road ever thought of going in there."

Oregon Pacific.—It it stated that Col. WM. M. HOAG, Vice-President and General Manager of this Oregon company, has secured additional capital for the work, and that construction will be resumed at an early date. Additonal steamers are also to be put on between San Francisco and Yaquina. The old story of a connection with the Chicago & Northwestern is also repeated.

Chicago & Northwestern.—It is stated that the company has bought the right of way and tunnel owned by a local company for a line from Whitewood, Dakota, to Deadwood and will begin work at once grading the line.

Rocky Fork & Cooke City.—The starting of a preliminary survey on the rival to this company, the Billings Clark's Fork & Cooke City, has aroused this company again, and a meeting of the directors was held at Laurel, Aug. 9, to make arrangements for resuming work on the grade.

Union Pacific.—A preliminary survey has been made, from Huntington, Ore., down the Snake river to the Pine Creek mines.

Northern Pacific.—It is reported that the company is to build two large steamers to ply between Tacoma and Alaska in the summer months, and between Tacoma and Honolulu in the winter season. The enterprise can hardly fail to give a great impetus to through tourist travel from the East.——It is expected that the Big Bend line will reach Davenport this season.——Work is to begin at once on the new shops at Tacoma. There will be erected a wood working shop 80 × 200 ft., car shops 100 × 600 ft., machine shop 120 × 220 ft., and blacksmith shop 80 × 200 ft. Besides these there will be a round house, holding 48 engines, and a freight warehouse 60 × 330 ft. The shops will employ about 700 hands.

——A letter from New Castle, Col., to the Denver *Republican* says: "After long waiting, and bright and roseate anticipations, it now looks as if there is absolutely no prospect for any railroad building in this section this year. It is a sad and sore disappointment. It will be a set-back to the business thrift hereabouts. Our coal mines will now have to lie dormant for another year. But this is only a postponement. Another year there certainly will be a stirring railroad activity from this point west to Utah, and the country will by that time be more developed, so that it will derive a greater immediate advantage from this work than would be the case at this time."

New Projects and Surveys.

Deming, Sierra Madre & Pacific.—This railway is to be built by the Sonora, Sinaloa & Chihuahua company, whose organization was announced last week. It is to run from Deming south to Las Palomas thence southwest to Guerrero, 300 miles, thence west to Alamos and north to Guaymas. The headquarters of the company are at Deming, N. M. GEO. H. SISSON is President; JAS. A WILLIAMSON of Albuquerque is Vice-President; CHAS H. DANE of Deming is Treasurer; JAS. C. TIFFANY of Deming is Purchasing Agent.

Tacoma, Orting & Southwestern.—This company has been organized at Tacoma, W. T., to build a railroad for supplying the St. Paul & Tacoma Lumber Company's mill. The line will leave the Cascade division of the Northern Pacific near Orting and will run southeast about 60 miles. Preliminary surveys are now in progress.

Antioquia.—This company has filed articles of incorporation at Albany, N. Y., to build a railroad from the city of Medellin, Republic of Colombia, to Puerto Berrio, on the river Magdalena. The list of incorporators includes JAS. S. NEGLEY, EATON N. FRISBIE of New York City, and EDWARD PAGE of Boston. The capital stock is $50,000.

Proposals Open.

Artesian Well.—M. A. BALDWIN, Elmore Station, Ala.

Railway.—Tennessee Midland, between Jackson and Tennessee river. TOOF, MCGOWAN & CO., or J. S. MCTIGHE & CO., contractors, Memphis, Tenn.

Railway.—Louisville, New Orleans & Texas Pacific; 25 miles, in Bolivar Co., Miss.; all embankment; average 12,000 to 15,000 cu. yds. per mile. TOOF, MCGOWAN & CO., 274 Front St., Memphis, Tenn.; or J. S. MCTIGHE & CO.

Artesian Wells.—Ten 6-in. wells, 150 to 250 ft. deep; with casing. F. J. DRICK, Orange, Tex.

Pumping Machinery.—Two pumping engines of 10,000,000 galls. daily capacity. JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y.

Water Pipe.—Cast-iron pipe; 12,000 pieces of 6-in., 6,000 of 8-in., 2,000 of 12-in., 1,500 of 16-in., 300 of 24-in. GEO. B. SWIFT, Commissioner of Public Works, Chicago, Ill. August 13.

Sewage Well and Pumping Plant.—Plans and specifications at the office of the City Engineer. F. MUNCHRATH, Chairman of Sewer Committee, Sioux City, Ia. August 14.

Granite.—Cut granite for Maryland Hospital for the Insane, near Catonsville. J. CRAWFORD NEILSON, Architect, 110 North St., Baltimore, Md. August 15.

Railway.—New York, Ontario & Western; from New Berlin to Edmeston, 7 miles. Specifications, profiles, etc., on file. E. CANFIELD, Chief Engineer; N. Y., O. & W. Ry., Middletown, N. Y. August 15.

Stone.—Indiana Bedford buff stone. Architect, M. RUMBAUGH, 66 W. 31st St., Cincinnati. JOHN LOUGHLIN, Sidney, O. August 15.

Masonry.—Erection and completion of additional basement and area walls, including excavation and concrete foundation, for public building at Wichita, Kan. W. A. FRERET, Supervising Architect, Treasury Department, Washington, D. C. August 15.

Excavation.—Improvement of shallow flowage, Pegan meadows, Lake Cochituate; about 60,000 cu. yds. of earth excavation. THE WATER BOARD, Boston, Mass. Aug. 15.

Street Work.—Grading, cobble stone paving, granite block paving. JOHN P. ADAMS, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. August 15, 21.

Bridge.—Over Bullock's creek. Plans and specifications on file. JAMES B. ALLISON, Clerk of Commissioners of York Co., Yorkville, S. C. August 18.

Cribs.—Two cribs at Sturgeon Point light station, Michi-

gan. Also rebuilding superstructure of crib at Racine light station, Wisconsin. Maj. S. M. MANSFIELD, U. S. Lighthouse Engineer, Detroit, Mich. August 20.

Sewer.—Vitrified stoneware pipe sewer; 20 and 12-in. pipe; manholes, etc. THOS. J. LANAHAN, Clerk, Board of Contract & Apportionment, Albany, N. Y. August 20.

Asphalt Pavement.—About 2,000 sq. yds. of asphalt pavement, and about 1,800 sq. yds. of asphalt walks in the public grounds. Col. JOHN M. WILSON, U. S. A., Office of Public Buildings & Grounds, War Department, Washington, D. C. August 20.

Steam Heating.—At Central Islip, L. I. DEPARTMENT OF PUBLIC CHARITIES, 66 Third Ave., New York City. August 21.

Laying Water Mains.—THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers St., New York City. August 21.

Street Work.—Regulating, grading, curbing and flagging. THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers St., New York City. August 21.

New Croton Aqueduct.—Iron lined masonry aqueduct near Shaft No. 30 on Section 14. Plans and specifications on file. JAMES C. DUANE, President, Aqueduct Commissioners, 280 Broadway, New York City. August 22.

Valves.—Fifteen 48-in. stop-cock valves and gearing. JAMES C. DUANE, President, Aqueduct Commissioners, 280 Broadway, New York City. August 22.

Ties, Lumber, Etc.—Ties, lumber, car roofing and sheeting. JOSEPH HICKSON, General Manager, Grand Trunk Ry., Montreal, Canada. August 25.

Buildings.—City and county buildings. Architect, E. J. LENNOX, Toronto. JOHN JONES, Chairman, Court House Committee, Toronto, Ont., Canada. August 27.

Water-Works.—Complete system. E. H. KILPATRICK, City Clerk, Caldwell, Kan. August 30.

Water-Works.—Bids for construction only, or for construction and operation. Plans and specifications at the office of the City Engineer of Waco, and at the office of GEO. C. MORGAN, C. E., 15 Major block, Chicago, Ill. A. HINCHMAN, Mayor, Waco, Tex. August 30.

Plans for Jail.—Plans for county jail on lot 41 × 120 ft.; $300 for accepted plans. J. F. MULGREW, Santa Rosa, Cal. September 5.

Contracting.

Dry Dock.—Proposals will be advertised for the construction of the Government dry dock at Kingston, Ont.

Tunnel.—J. C. Carpenter & Co., of Richmond, Va., have the contract for the Eighth St. tunnel at that city.

Sewerage.—At Montgomery, Ala., all the bids for completing the sewerage system have been rejected, and new bids called for. The list of bids was given last week.

Pumping Engine.—The Town Council, Windsor, Ont., has awarded the contract for a pump of 3,000,000 galls. daily capacity, to Kerr Bros., of Walkerville, for $10,000.

Cable Railway Plant.—F. C. FLORENCE, Chief Engineer of the Union Cable Ry., at Kansas City, Mo., has awarded the contract for machinery to the Walker Mfg. Co., of Cleveland, O.

Water Pipe.—The Water Committee, Montreal, Canada, has awarded a contract to Geo. Hipley & Son for 450 tons of 12-in. and 200 tons of 6-in. pipe at $36 per ton.

Granite.—The Bodwell Granite Co., of Rockland, Me., has the contract for a six-story front of Jonesboro red granite at Newark, N. J.

Bridge Masonry.—At Troy, N. Y., the contract for the mason work on the new bridge over the Poestenkill at 2nd St., has been awarded to Malone & McKenna, at $6,221.

Water Tower.—The contract for the water tower at Cedar Falls, Ia., has been let to W. A. Lee, of St. Paul, Minn., for $5,594, complete. LOWETH & CURTIS, of St. Paul, are the engineers.

Water Works.—*St. Ignace, Mich.*—The contract for the construction of the water-works, complete, has been let to Geo. C. Morgan, of Chicago, who designed the works, for $37,430.

Electric Railways.—*Danville, Va.*—The Danville Street Railway Co. will adopt an electric system, and has contracted for the plant. The line will also be extended.

Manchester, Va.—The Manchester Street Railway & Improvement Co. has decided to adopt an electric system for the street railway, and will commence work at once.

Street Railway Material.—The Dummy Railroad Co. of Dayton, Ala., will soon advertise for bids for the construction and equipment of the road. The line has been surveyed, and cross-ties are being cut. President, H. W. MORGAN.

Kansas City, Kan., is making great improvements. The city council has let contracts for public works amounting to $175,000. Work has also commenced on the twelfth bridge across the Kaw river to cost $66,000.

Bridge.—The following proposals have been received by J. P. ADAMS, Commissioner of City Works, Brooklyn, N. Y., for removing and rebuilding the Third Ave. bridge over the Gowanus canal: Daniel J. Creem, $37,000; Chas. Hart, $39,700; Stewart & McDermott, $42,700; Booth Bros., $44,990.

Dam.—The new dam at Holyoke, Mass., will be 2,000 ft long, built of rubble masonry. It will form a storage reservoir with a surface area of 114 acres and about 16 ft of water. It will be built to half the height this year, and completed next year. The plans have been prepared by City Engineer ELLSWORTH.

Pumping Machinery.—The Board of Trustees, Sacramento, Cal., have received the following proposals for a new pumping engine of 1,000,000 galls. daily capacity: Holly Mfg. Co., Lockport, N. Y., Gaskill engine, No. 7, $38,000; No. 6, $30,000. Parke & Lacy, San Francisco, Cal., Knowles engine, $40,000. A. L. Fish, San Francisco, Worthington engine, $38,100, $38,500, $41,000. H. P. Gregory & Co., San Francisco, Cal., Blake engine, $47,500.

Pipe Sewer.—The city of Ashland, Wis., is laying about 15,000 ft. of cement sewer pipe; 22 in. × 29 in. oval; 15 in. × 23 in. egg-shaped, and 8 in. circular. The Eau Claire Cement Pipe Co. is furnishing the pipe. Most of the large sizes is made at Ashland. J. P. Fox, of Eau Claire, has the contract for trenching and pipe laying. The plans for the sewerage system were made by CHESTER B. DAVIS, C. E., of Chicago.

New Croton Aqueduct.—At the meeting of the new Board of Commissioners on Aug. 1, plans and specifications submitted by the Commissioner of Public Works for building an iron lined masonry aqueduct near Shaft 30, on Section 14; were approved and adopted. Proposals were ordered to be advertised for this work and for 48-in. stop-cock valves and gearing; the proposals will be opened Aug. 22.

The Commissioners have awarded to O'Brien & Clark the contract for deepening and completing Shaft 24, to connect with the tunnel under the Harlem river, upon their bid of $84,422.50. The next lowest bid was $85,020.

Harvard Bridge.—The following proposals were opened Aug. 6 by the Harvard Bridge Commissioners, at Boston, Mass., for the construction of the draw foundation and pier for the Harvard bridge across the Charles river between Boston and Cambridge: Boynton Bros., Boston, $26,875; McInnes & Parker, Boston, $29,000: Wm. S. Norton, Boston, $31,498; J. N. Hayes & Co., Boston, $33,312; F. G. Whitcomb, Boston, $36,865. The contract was awarded to Boynton Bros.

Rip-Rap.—The following proposals for stone for rip-rap work on the Connecticut river have been received by E. C. DAVIS, C. E., Northampton, Mass.: F. M. Cook & Sons, Northampton, $1.75 per cu. yd. for 1,000 cu. yds. or more; Wm. P. Latham, of Florence, Mass., $2 per cu. yd. for 3,000 cu. yds. or all; Geo. M. Atkins & Co., Palmer, Mass., $2.30 per cu. yd.; Geo. W. Hendricks, Easthampton, Mass., $2.40 per cu. yd.; Boston & Maine R. R. Co. (W. BISSELL, Chief Engineer), Boston, Mass., $2.65 per cu. yd. Contracts were awarded to F. M. Cook & Sons, for 1,000 yds. at $1.75, and to Wm. P. Latham, for 3,000 yds. at $2.

Submarine Pipe Laying.—A new line of 6-in. cast-iron water pipe is being laid across the East River from 79th St., New York, to Blackwells Island; it will furnish 1,500,000 galls. per day. At present all the water on the island is obtained through the line running from 62nd St. which was laid about 15 years ago, and which is of wrought-iron, inclosed in a covering of oak, filled with cement to prevent the action of the salt water upon it. The new pipe has no covering.

Trenching and Pipe-Laying.—The following proposals have been received by the Executive Board, Rochester, N. Y.: Group No. 135; Wm. Dyer, $2,917.90; Geo. Chambers, $3,043.15; Wm. Fuller, $3,709.30; N. L. Brayer, $4,471.20: John Howe, $4,555,30; David Clancy, $5,377.30; Weider & McMahon, $5,677. The contract was awarded to Wm. Dyer, as follows: 11,405 lin. ft. of excavating and back filling, 15 cts. per ft.; 2460 ft. of 10 in. cast-iron pipe and specials, 14 cts. per lin. ft.; 1,860 ft. of 10 in., 12 cts., 6,455 ft. of 8 in., 9 cts.; 550 ft. of 4-in., 8 cts.; additional 8 and 10 in. lead joints, 50 cts.; 6-in. 30 cts.; 4-in. 25 cts.——Group No. 136; Geo. Chambers, $2,679.50; Wm. Dyer, $2,958.15; Weider & McMahon, $3,317.70; David Clancy, $3,579.70; John Howe, $3,743.75; N. L. Brayer, $3,764.30. The contract was awarded to Geo. Chambers, as follows: 7,815 lin. ft. of excavation and back-filling, 23 cts. per ft.; 380 lin. ft. 12-in. cast-iron pipe and specials, 18 cts.; 700 ft. of 10-in., 16 cts.; 170 ft. of 8-in. 14 cts.; 4,715 ft. of 6-in., 11 cts.; 1,760 ft. of 4-in, 9 cts.; 12, 10 and 8-in. lead joints, 2 cts.; 6 and 4-in., 1 ct.——Group No. 137; Geo. Chambers, $3,729.05; N. L. Brayer, $4,082.30; Wm. Dyer, $4,350.85; John Howe, $4,775.55; David Clancy, $6,305.25; Weider & McMahon, $7,848.55. The contract was awarded to Geo. Chambers, as follows: 12,145 ft. of excavation and back-filling, 19 cts.; 2,605 lin. ft., of 10-in. cast-iron pipe, 15 cts.; 3,195 ft. of 8-in. 13 cts.; 5,310 ft., of 6-in., 10 cts.; 920 ft. of 4-in., 9 cts.; 10, 8, and 6-in. lead joints, 5 cts.; 4 in. 1 ct.

Dredging.—The following proposals for dredging in the Hudson river have been received by JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y.: Round shoal; P. W. Myers, 28½ cts. per cu. yd.; Lane & Brumelkamp, 29.9 cts.——Arsenal dock, Troy; Lane & Brumelkamp, 35 cts.; P. W. Myers, 38½ cts.——Bogart light; E. M. Payn, 16⅞ cts.; P. W. Myers, 22½ cts.; Lane & Brumelkamp, 25 cts.——Parda Hook; P. W. Myers, 15½ cts.; E. M. Payn, 21 cts.; Lane & Brumelkamp, 24 cts.——At Troy, N. Y.; P. W. Myers, 38 cts.; Lane & Brumelkamp, 40 cts. Contracts were awarded to the lowest bidders.

Water-Works.—*Phenix, R. I.*—The Phenix Water Co., R. G. HOWLAND, President, has decided to extend the present water system through River Point, making a 10 years contract with the citizens along the line. The length will be 6¼ miles and contracts have been awarded as follows: pipe, Warren Foundry & Machine Co., Phillipsburg, N. J.; hydrants and valves, Ludlow Valve Co., Troy, N. Y; pipe laying, H. B. Leach, Philadelphia, Pa. The contract calls for the completion of the new water system by Jan. 1, 1889. The new district will be more extensive than the present one, having 63 hydrants, while the present one has only 40; there will also be a larger number of valves, 37 having been ordered.

Newton, Pa.—The following proposals have been received recently by the Newton Artesian Water Co. for the construction of water-works; including a reservoir with a capacity of 500,000 galls., 3½ miles of 4, 6 and 8-in. cast-iron pipe, 3½ tons of branches and specials, 20 fire plugs, valves, etc.: Thomas H. Ryan, Philadelphia, Pa., $15,768; S. Robinson March, Phœnixville, Pa., $17,759; Opperman & Hillport, Holmesburg, Pa., $17,804; S. C. Eastborn, Langhorn, Pa., $20,186; T. Wm. Harris & Co. New York, $21,228; Malcolm Peters, Philadelphia, Pa., $28,722.

Western Maryland Railroad.—The contract for building the Baltimore & Harrisburg Railway (Western Extension) from Ortanna, Adams Co., Pa., 8 miles west of Gettysburg, to a junction with the main line of the Western Maryland R. R., in Washington Co., Md., near Blue Ridge Summit Station, Franklin Co., Pa., has been awarded to Messrs. Keller & Crossan (John Keller, of Lancaster, Pa.; Kennedy Crossan, of Philadelphia, Pa.). The following are the prices to be paid per cubic yard for the various kinds of work: For tunnel excavation, $3; solid rock, 70 cts.; loose rock, 35 cts.; earth, 20 cts.; first class bridge masonry, $8; second class bridge masonry, $6; culvert masonry, $3; ballast, 70 cts. The contract does not include bridge superstructure, of which there is very little, nor tracklaying. The length of line under contract is 15 miles. The route is practically that of the old Tapeworm Railroad, projected and partially constructed by Hon. THADDEUS STEVENS, some 51 or 52 years ago. Changes are made to avoid two of the tunnels, and to shorten the line about 1½ miles. Ten miles of the line under contract is on the ascent of the Blue Ridge Mountain from the old Maria Furnace to Blue Ridge Summit. The road is to be completed and put in operation to Fairfield, Pa., this fall, probably by the middle of November, and the entire line is to be completed by May 1, 1889. J. M. HOOD is President and General Manager of the Western Maryland R. R., with office at Baltimore, Md.

WATER.

St. Louis, Mo.—The new engine for the water-works has been given a trial test. It is a high pressure beam engine, cylinder 85 ins. diameter and 10 ft. stroke; and has a daily capacity of 16,500,000 galls. It was built by the Fulton Iron Works, of St. Louis.

Poor Water Supply.—*Mt. Vernon, N. Y.*—There has been complaint as to the condition of the water supply, nd several cases of sickness are attributed to the water. The mains are to be examined to see if they have been fouled by dead fish or other matter.

Philadelphia, Pa.—The question of the bad quality of the water supply, owing to pollution by sewage, drainage from cemetries, etc., is again being agitated. The Delaware water is said to be of good quality before it is polluted.

Rochester, N. Y.—The quality and quantity of the present supply is again being discussed. City Engineer TUBBS states that an additional conduit, pumping station, etc., for doubling the present supply from Hemlock lake, would cost $800,000; and by limiting the annual expenditure for pipe extension to $50,000, which would be sufficient, the city could well afford to appropriate $800,000 for the proposed new conduit. The interest on that sum at 3 per cent. would be $24,000. That would make a total of $74,000 a year, over $20,000 less than the city now pays for pipe extensions alone; the amount devoted to this purpose for this year being $100,000, which is too large. An increased water supply is urgently needed.

Denver, Col.—For the last few months there has been much complaint at the insufficiency of the water supply for irrigation. Every year the question of this water supply is becoming more troublesome. The city wants more water. Thousands of trees have perished during the past two or three years, and the streets often go too long without being flushed. At the same time the farmers, some of whom settled along the Platte 25 years ago, say their rights are prior to those of Denver, and they must and will have water for their crops. The committee fully realizes the gravity of the situation; the general opinion was that they did not wish to deprive the farmers of sufficient water for their crops, but at the same time Denver must have her share, and would have it. There is said to be much seepage from the ditch. The Joint Water Committee has ordered the contractor, Joseph Williams, to at once place locks on the box regulating the amount of water supply to farmers along the line of the ditch; and to place the gauge so that the exact amount, and no more, water than their receipt shows them entitled to shall be furnished.

Jersey City, N. J.—The Board of Finance & Taxation has fixed the annual appropriation at $1,725,951.87. Of this sum the Board of Public Works gets $59,799.76.

Marion, O.—JOHN W. HILL, M. E., of Cincinnati, O., has been engaged to prepare plans and specifications for a system of sewerage to cost about $60,000.

Memphis, Tenn.—The Equitable Gas Co., a new company, with a capital stock of $500,000, has commenced operations and is now furnishing gas. The city has now two gas companies.

Grand Island, Neb.—The city obtains its water supply from driven wells. There is a large well 20 ft. deep, at the bottom of which are thirty-two 2-in. wells; pipes from the wells lead to the main suction pipe of the engine. At Sacramento, Cal., the Water Committee of the Improvement Association is considering the advisability of introducing a similar plan.

Water Supply of Boston, Mass.—Steps will soon be taken to purify the water supply of Boston by the removal of about 60,000 cu. yds. of earth from the bottom of Lake Cochituate. This will deepen the basin and do away to a great extent with weeds and vegetation which thrive in shallow water.

Sewage Disposal.—City Engineer SCOWDEN, of Louisville, Ky., has, at the request of the Sanitary Committee of the Central Kentucky Lunatic Asylum, prepared plans for a system of sewage disposal by distributing it over the the grounds as a fertilizer. The simplest plan will involve an expenditure of $12,000 for machinery, pipes, etc., while a more elaborate plan will cost $20,000. The plans will be considered shortly and one of them decided upon.

Jersey City N. J.—The Board of Public Works has decided to again advertise for proposals for furnishing the city with a new water supply; also for bids for filtering the present supply. This action was taken at the instance of the Corporation Attorney and Council of Bayonne, who claim the supply furnished that city by Jersey City is impure, and, if there is not an improvement, they will go elsewhere for water.

Birmingham, Ala.—The Birmingham Water-Works Co. has awarded to Dunn Bros., of Columbus, Miss., the contract for the construction of two tunnels, one 400 ft. and one 2,200 ft. long, a reservoir covering about 30 acres, and a canal 6 miles in length. The company will furnish pumping machinery and pipes. The water will be taken from the Cahaba river and pumped into the reservoir, on Shades mountain, 3 miles distant, whence it flows into the city. The daily capacity will be about 8,000,000 galls.

Irrigation.—***Folsom, Cal.***—Work is progressing on the irrigation canal which is being constructed by convict labor for the Folsom Water Power Co. The western side of the canal will be a wall of rough undressed granite, 10 ft. wide at the top and 19 ft. 6 ins. at the bottom. The material for this is being quarried on the ground. A temporary dam and a flume are being built to divert the course of the river in order to enable the construction of the permanent dam to be commenced. Two of the derricks will be operated by water power, and the other two by steam. P. A. HUMBERT is Chief Engineer; and JOHN CALVERT is the contractor.

Burlington, Ia.—The following are the principal points in the new water ordinance: The company is given an exclusive privilege for 25 years; 5½ miles of additional mains to be laid under the direction of the City Council, and additional hydrants to be placed as to make the total number not to exceed 300. Artesian wells are to be sunk and in case they are not a success, a filter-bed is to be constructed, fire proof buildings to be erected, and the necessary machinery to be put in operation to furnish the citizens with good filtered water. The hydrant rental is to be $20,000 for 300 hydrants; $10 each per annum for extra ones on the present lines and additional 5½ miles, and $50 each for all those on future extensions. The city reserves the right to purchase the works at the expiration of 10 years or any succeeding term of five years, upon one year's previous notice; the valuation to be fixed by three disinterested parties, to be chosen one by the city, one by the company, and these two to select the third.

Sewers.—***Greenfield, Mass.***—The selectmen are extending the sewers, and will build a sewer to take the place of a present open brook.

Lowell, Mass.—The Common Council has voted a loan of $50,000 for sewers. Work has been commenced on the Vernon St. sewer, 550 ft. long.

Jamestown, R. I.—The Town Council has taken action with regard to securing better sewerage.

Willimantic, Conn.—Work is progressing on the sewer. The work is being done by contractor Durfey.

Cincinnati, O.—The trunk sewers in Ludlow Ave. and Hamilton pike, Cumminsville, are completed; in some places the trench was 17 ft. deep and 8 ft. wide. Work is now in progress on Bluerock St., and the entire job is expected to be completed in September. The contractors are Huston & Walsh.

Hastings, Neb.—The drainage question is being agitated, typhoid fever having appeared again. The city is very flat.

Portland, Ore.—A sewerage system for East Portland is considered necessary, and the matter is being agitated.

Galveston, Tex.—Contractor Siegel, of New York, who has the contract for boring a series of artesian wells to supply the new city water-works now under construction, the united capacity of which shall be 2,000,000 gallons daily, for which he is to receive $80,000 if successful, has struck with his first well, at a depth of 747 ft., the deepest water-bearing stratum of sand yet penetrated. The depth of the stratum is 55 ft., and the flow of water is fully as strong as that secured at any of the wells sunk in this city before development. Boring was at once suspended and a 10-in. strainer has been sunk the entire depth of the water-bearing stratum of sand. It is thought that when this well is thoroughly developed, it will yield from 400,000 to 500,000 galls. daily. The second well under way has reached a depth of 500 ft., and is making favorable progress. It is located on a line with the first well, and is about 20 ft. distant from it.

Brooklyn, N. Y.—City Works Commissioner ADAMS has awarded to Andrews & Co. the contract for constructing driven wells on land owned by the city just below Baisley's Pond. Under the contract the firm is to guarantee to supply 6,000,000 galls. of water a day, and is to receive $175,000. If the yield shall exceed this, it will be taken by the city without extra expense, and if it shall be less, than the contractors will be proportionately reduced. The contract includes machinery, plant, etc. There will probably be about 100 wells and by the end of September the city will begin to receive the water from them. The city now has four driven well pumping stations and all were constructed by Andrews & Co. They are known as Spring Creek, Baisley's, Clear Stream and Forest Stream. Together they produce a very large proportion of the water consumed by Brooklyn, and had it not been for these stations Brooklyn would have long since experienced a water famine. Andrews & Co. were paid at the rate of $36,000 for each million gallons. There are also to be engine and boiler houses near Baisley's Pond, the design being to get more water from the pond. They will cost $25,000. This action of the Commissioner is the first taken under the resolution of the Aldermen recently passed, authorizing the issuance of $1,300,000 worth of bonds for the extension of the water supply of the city.

The reservoir at Ridgewood as at present constituted, is capable of holding 160,000,000 gallons of water, or sufficient to supply the city for between three and four days. The proposition of the Commissioner of City Works is to make it twice as large, or to give it a capacity of 320,000,000 gallons. It is now divided into two parts, and with the extension there will probably be four separate basins.

It is roughly estimated that the improvements to be made will give the city an increased supply of water of 20,000,000 gallons per day, or sufficient for all present needs.

Water-Works.—***Massachusetts.***—Boston. The Water Board has asked for an additional loan of $100,000 for the extension of mains.——Winchendon. An additional sum of $300 has been appropriated for investigations as to a water supply.—— Great Barrington. Another stream has been diverted to the reservoir.——Lynn. Babb & Hatchard have purchased the business of the Lovers' Leap Spring Water Co.

Connecticut.—Windsor Locks. The charter of the local company will be purchased by Fennessey, Armstrong & Co., of Springfield, Mass., if the town will grant an exemption from taxation for 10 years. It is proposed to pump to a stand-pipe by water power.

New York.—Geneva. The water-works extension is approaching completion.——Clyde. Trenching and pipe laying will be commenced soon.——Fulton. The village has made a 5 years contract with the water company, and will pay $40 per hydrant.——Albany. Work is progressing on the reservoir for a new water supply.

Pennsylvania.—Allegheny. It is stated that most of the side streets have 4-in. mains, which would not furnish sufficient water in case of a big fire.

Maryland.—Baltimore. Jones & Thorn have commenced work on the 40,000,000 galls. reservoir at Guilford. The work will cost $40,260.

Ohio.—Zanesville. The Trustees of the Water-Works propose to erect a new stand-pipe for the high service system at a cost of $40,000.

Virginia.—Lynchburg. A Holly engine of 2,000,000 or 3,000,000 galls. daily capacity, has been purchased for $21,200.——Clifton Forge. Water-works are projected.

Georgia.—Americus. The water-works were tested Aug. 2, with satisfactory results.

Florida.—Kissimmee. The Kissimmee Water Co. will have surveys and estimates made at once.

Alabama.—Mobile. The City Council has approved the contract with the water company for 260 fire plugs at $50 each per annum for 6 years.——Russellville. Water-works are projected.

Illinois.—Hopedale. The water tower and tank are finished; the tower is 40 ft. high, and the tank is 16 ft. high, with a capacity of 1,500 barrels. C. M. Houghton, of Delavan, was the contractor. Water will be pumped from the 200 ft. well by a pump furnished by M. Loudon, of Bloomington.

Iowa.—Cherokee. A system of water-works is to be established.

Kansas.—Caldwell. Proposals for water-works are being received. Address, E. H. KILPATRICK, City Clerk. ——Wichita. The East Wichita Water Co., $50,000 capital stock, has been incorporated by A. A. HYDE, H. IMBODEN, J. C. RISTAN, and others.——Fairmount. Trenching and pipe laying is in progress.

Nebraska.—Pawnee City. Proposals are being received for water-works. The supply will be obtained from tube wells. A. A. RICHARDSON, of Lincoln, is the engineer.——Lincoln. When the new pumping machinery is in operation water will be drawn from over 100 driven wells, each having a flow of 20 galls. per minute. Only 60 wells are now in use.

Montana.—Helena. The new pumping engine for the Woolston water-works has been delivered.

Oregon.—Portland. The East Portland Water Co. has presented a bill at the rate of $200 per month, but offers to take $150 per month if the city will grant a 7 years contract, dating from November, 1887.

California.—Benicia. The water company has 40 men at work on the lower dam.——San Bernardino. It is proposed to issue bonds and build water-works.——Santa Ana. The city proposes to issue bonds for $25,000 for water-works.——Sacramento. There is considerable discussion over the water question; the mayor favors a supply from the Sacramento river, with the Hyatt filter system; but artesian wells 115 ft. deep are also suggested. The Improvement Association favors the latter method.

Texas.—Waco. The city is advertising for proposals for water-works, but for present emergencies the Council has made a contract for 1 year with the Waco Water Co.; taking 117 hydrants at $75 each.——Waxahachie. The city has decided to put in a system of water-works at a cost of about $30,000. The city will own the works. Water will be taken from Waxahachie creek.——Houston. The Houston Water-Works Co. is laying new 16-in. mains.

Canada.—Montreal. A larger service main will be laid to the municipality of St. Louis. The new Worthington engine of 10,000,000 galls. daily capacity has been tested. ——Lachine. A company of Canadian and American capitalists has offered to construct and operate a system of water-works at Lachine, stipulating that in 20 years the town shall purchase the works for $75,000 and the cost of any additions that may be hereafter made, plus 10 per cent. of the whole price as a bonus. M. BEAUCHEMIN, of Sorel, has also made an offer and is preparing plans and specifications.

Holyoke, Mass.—A question has arisen as to the right of the Water Commissioners to build the proposed dam at the Whiting Street brook, without first bringing the matter before the city government, but an investigation shows that the Board are acting legally, under the provisions of chapter 67 of the acts of 1884. It provides that the city, through its water commissioners, may take and use the water of the Whiting Street brook, and may take by purchase or otherwise, all lands, rights of way, easements for flowing, raising, holding and conveying such water. They can erect suitable dams and buildings, make excavations and raise embankments. They must file within 90 days a description of all property taken while making improvements, and provision is also made for paying land damages. For the purpose of paying all expenditures and liabilities incurred, the commissioners can borrow such sums of money as they may deem necessary, to an amount not exceeding $30,000, and can issue therefor notes or bonds payable after one year in instalments of not less than $5,000, with interest not less than 6 per cent. This loan may be paid as provided year by year from the sinking fund, providing that it can be paid after contributing not less than 1 per cent, a year to the sinking fund from the surplus receipts of the water-works of that year, and the whole amount of the water debt outstanding. The act was accepted by both Boards of the City Council. When the water of the Whiting Street brook was taken it was paid for out of the surplus funds. The Board do not intend to expend more than $30,000 on the work this year, which will leave it partly done, and whenever they are obliged to exceed $30,000 they will have to go to the City Council.

Artesian Wells.—***Winchester, Tenn.***—An artesian well is to be put down by W. A. CRANE.

Allendale, S. C.—About $2,000 have been subscribed for putting down a well. Address J. M. GRAY.

Charleston, S. C.—The new well is down 1,375 ft. and will be continued to 2,000 ft., which is the depth of the other wells. Water was struck at 1,250 ft. and is flowing 40 galls. per minute.

New Orleans, La.—The well of the Consumers' Ice Co. put down by the Southern Artesian Well Co., has a natural flow of 50 galls. per minute, and the ice company is now pumping 125 galls. per minute.

Selma, Ala.—Wells will be put down by the Southern Artesian Well Co., of New Orleans, La.

Butler, Ala.—About $1,000 have been subscribed by the County Commissioners and private parties, for an artesian well. Address J. COURSON.

Decatur, Ill.—A water supply is proposed for a system of driven wells. A contract has been let for a test well.

Cairo, Ill.—An artesian well is projected. Address Capt. W. M. WILLIAMS.

Nebraska City, Neb.—The well at the packing house is down 900 ft., but the water is very salt.

Astoria, Ore.—T. G. BRAMEL is at the head of an enterprise for boring an artesian well. Subscriptions are being received.

Galveston, Tex.—The two wells at the cold storage warehouse, furnish a supply of 617,000 galls. per day. They were put down by contractor Byrnes.—Work is progressing on the city well by contractor Siegel.

Bonham, Tex.—Work is to be commenced shortly on the wells for the water-works. Address the mayor.

Washburne, Tex.—The Washburne Town Co. will sink an artesian well for a water supply.

Waco, Tex.—An artesian well has struck a good flow of water at a depth of 1,180 ft.

Electric Lighting.—*Farmington, Me.*—The village corporation will contract with the Farmington Electric Light Co. for 25 street lights.

Manchester, N. H.—The Manchester Electric Light Co. has been granted a three years' contract for 200 lights, at 39 cts. per light per night, or 43 cts. if mast arms are required.

Great Barrington, Mass.—The Prudential Committee will contract for 20 electric street lights, at $1,500 per year.

Easthampton, Mass.—The electric light committee has granted a franchise to E. T. SAWYER, H. G. KNIGHT and C. W. SMITH.

Chambersburg, Pa.—The Chambersburg Gas Co. proposes to put in an electric light plant.

Annapolis, Md.—The Annapolis Electric Light Co. will put in three engines of 100 H. P. each; one for the arc system, one for the incandescent system and one for reserve.

Coshocton, O.—The Coshocton Electric Light Co. has been incorporated, with a capital stock of $10,000.

Paducah, Ky.—The Paducah Gas Co. will put in an arc and an incandescent electric light plant. The system is not yet decided upon.

Covington, Ky.—The Kenton Electric Light Co. has applied for a franchise.

Columbus, S. C.—The Congaree Gas & Electric Light Co. has contracted to furnish the city with 14 arc lamps.

Albany, Ga.—The electric light company will put in an Edison plant. J. S. DAVIS is Secretary.

Rome, Ga.—The Thomson-Houston electric light system has been put in operation.

New Orleans, La.—The Louisiana Electric Light & Power Co. has purchased the plants and franchises of the Brush Electric Light Co. and the Westinghouse Electric Co. The plant recently burned will be replaced, and the contracts of these companies carried out.

Natchez, Miss.—The Citizens' Electric Light Co. has been organized; President, L. BALTO; Treasurer, A. G. CAMPBELL. Capital stock, $25,000. The Van Depoele Electric Mfg. Co. will furnish the plant.

Meridian, Miss.—The Westinghouse Electric Co., of Pittsburg, Pa., will put in an electric light plant.

Little Rock, Ark.—The Little Rock Electric Light Co. will add an incandescent plant to its system.

Normal, Ill.—An electric light plant is proposed to be put in. A local company will probably be formed.

Berlin, Wis.—An electric light company will probably be organized.

Telluride, Col.—The electric light system has been put in operation. The plant is operated by water power.

Corvallis, Ore.—An electric light system is proposed.

Vancouver, Wash. Ty.—The Vancouver Electric Light & Power Co. has been incorporated by WM. E. MATSON, DAVID WALL, CHAS. BROWN, and others. Capital stock, $15,000.

Merced, Cal.—The Merced Electric Light Co. has been incorporated by W. E. DEAN, A. K. P. HARMON, C. E. ELLIOTT, and others. Capital stock, $100,000.

Ingersoll, Ont.—The Reliance Electric Light Co., of Waterloo, has contracted to put in electric lights at 25 cts. per light per night.

Pembroke, Ont., Canada.—A report on the proposed system of water-works has been made by WILLIS CHIPMAN, M. Am. Soc. C. E., of Brockville, Ont. The town is situated on sandy soil on the south shore of Lake Allumette, an expansion of the Ottawa river, which is about 8 miles by 1¼ miles; the Muskrat river flows through the town, furnishing power for mills, and the Indian river joins the Muskrat within the town. The different systems of supply are referred to, and pumping to a standpipe recommended. The amount of water necessary to supply the town, which has a population of about 5,000, would be about 200,000 galls. per day for all except fire purposes; and for fire purposes sufficient water is required to give at least three 1⅛-in. streams 100 ft. high, or about 600 galls. per minute, being at the rate of 864,000 galls. per day. After considering the different sources, he recommends the water from Lake Allumette, the supply to be taken above the town to the west, at a distance of about 800 ft. from the shore, in 8 ft. or 15 ft. of water at high or low water. The pumping machinery to consist of a duplicate set of compound duplex pumping engines. The pipe system to consist of 5,700 ft. of 12-in. pipe from pumping station to western town limit; and the following for distribution, 500 ft. of 12-in., 2,250 ft. of 10-in., 2,450 ft. of 8-in., 6,800 ft. of 6-in. and 10,000 ft. of 4-in. Double nozzle hydrants are recommended. The cost is estimated at $50,000 without stand-pipe, for a complete system, capable of being extended to supply a population of 10,000; a stand-pipe would cost about $15,000, or an elevated tank about $13,000. He refers to the offer made in December, 1887, by a local company, to build and operate water-works, but in view of the small cost of the works he sees no reason why the town should not construct the works for itself. Surveys and levels for the proposed plan were made by J. L. MORRIS, C. E., of Pembroke.

Ellsworth, Me.—C. C. BURRILL can give information regarding the proposed water-works.

Waldoboro, Me.—The incorporators of the Waldoboro Water Co. have been notified to meet for organization Aug. 10. The town has voted to give the company an annual subsidy of $600 for ten years.

Claremont, N. H.—W. N. Ellis & Co. are constructing the water-works.

Orange, Tex.—Lutcher & Moore write us that they have bought the material needed in the construction of the water-works they are putting in at this place.

Special Reports of Water-Works Construction.

THE ENGINEERING NEWS MANUAL OF AMERICAN WATER-WORKS is now being compiled, and will be *indispensable* to every manufacturer, engineer and contractor in any way interested in Water-Works construction and maintenance, and will be of great value to Water Works superintendents and projectors of new works.

Superintendents of water-works and water companies will wish to see correct and complete data concerning their Works in our MANUAL, and to ensure this they should send in reports *at once* upon the blanks which we have already sent to every Water-Works office in the United States and Canada. Many have delayed their report, and if the blanks we intended for them have been lost in the mail, or mislaid, we will send more upon request.

We *must* have a report from every public water supply system in North America, so those who reply to our inquiries at once will save a second inquiry. We also wish to know of *every* new Water-Works plant in process of construction, and of *every* new project in this line. We will send to any one desiring them, blanks upon which reports can be made.

Further details of the MANUAL will be advertised later. We abstract from our special reports for the MANUAL the following items of current interest:

GROTON, N. Y., July 19, 1888.

EDITOR ENGINEERING NEWS:—We are to have a gravity system of water-works, the supply to be conveyed from springs through 1½ miles of 4-in. pipe to a 1,000,000-gall. reservoir located opposite and 200 ft. above the town. There will be about 2¾ miles of 8, 6 and 4-in. mains. The works are to cost $25,000 and to be owned by the village. Bids for construction to be closed July 28. The Board of Water Commissioners are: BENN CONGER, Prest.; D. T. BRADLEY Treas., and W. D. BALDWIN Secy.

MEYERSDALE, Pa., Aug. 1, 1888.

EDITOR ENGINEERING NEWS:—The Sand Spring Water Co. will complete its works in October. S. CHAMBERLAIN is Prest., S. B. PHILSON, Secy., W. B. COOK, Treas. and G. L. BENFORD, Engr. of the company. J. S. GRAVES of Meyersdale has the general contract for the works and JNO. PORTER the masonry contract. The pipes and specials will be furnished by the Scottsdale Pipe Works. The supply will be conducted by gravity from Sand Spring to a 1,000,000 gall. reservoir. There will be 4¼ miles of pipe, 100 taps, no meters and 20 hydrants. The ordinary and fire pressures will each be 110 lbs. Stock to the amount of $10,500 has been subscribed and it is expected that $5,500 bonds at five per cent. will be issued later on. It is hoped that the annual operating expenses will be as low as $300, and that the revenue from consumers will be $1,000, and from the City, $600 a year. Population 2,000. L. A. SMITH.

PIERCE CITY, Mo., July, 1888.

EDITOR ENGINEERING NEWS:—A gravity system of water-works is now being constructed here by J. GUINNEY who acts as Constructing Engineer and Superintendent, and who will own the works. The Designing Engineer is J. W. NIER of Kansas City, Mo. The source of supply is a large spring in Guinney lake, and the water will be pumped to a stand-pipe 15 ft. in diameter and 75 ft. high. There will be 7 miles of pipe and 22 hydrants, the city paying $1,700 a year for the latter. The works will cost about $40,000. Population, 4,000.

G. H. SCHASEN, *City Clerk.*

ANACONDA, Mont., July, 1888.

EDITOR ENGINEERING NEWS:—Pipe laying was begun here June 25. There will be 6¼ miles of wrought-iron Kalamein pipe, size, from 4 to 8 ins. The reservoir is being lined and we expect to have water in the city by Aug. 20. JNO. R. TOALE is Superintendent of Construction.

THOS. W. BROOKS.

MILES CITY, Mont., July, 1888.

EDITOR ENGINEERING NEWS:—The water supply question has gone no further than a generally expressed desire to have an adequate supply for fire and domestic purposes. Water would be taken from the Tongue river, and Holly system preferred, for which I think the city would give a 20 years franchise and pay from $1,500 to $2,000 a year for fire plugs. S. GORDON.

PITTSBURG, Pa., July 25, 1888.

EDITOR ENGINEERING NEWS:—I enclose herewith a report of the North Platte Water-Works Co., which, if you desire, you can insert in your valued journal.

W. S. KUHN, *Gen. Man. Am. W. W. & Guarantee Co.*

NORTH PLATTE, Neb.—This city lies on the line of the Union Pacific Railroad, about 350 miles west of Omaha, and although laid out only 10 years ago, it has grown to be a city of 5,000 inhabitants, and contains many thriving industries, among which may be mentioned several large flouring mills. There are also three banks and numerous business houses, a fine court house, schools and churches. The surrounding country with its productive land furnishes excellent opportunities for farming, while the city provides a ready market for the products of the farm.

In response to an imperative demand for an adequate water supply both for general use, and for fire protection, this was found in August, 1887. The North Platte Water-Works Co., with a capital stock of $125,000, having secured a liberal franchise from the city, dated July 14, 1887, and a majority of the stock being held by the American Water-Works & Guarantee Company, Limited, of Pittsburg, Pa., the latter company entered into a contract with the local company to construct the works. Work was commenced about September 1, 1887, and continued vigorously until the cold weather interfered, when it was stopped for the winter; not, however, until sufficient hydrants had been set and machinery placed to protect the business portion of the town against fire.

The works when completed will consist of 6 miles of cast-iron mains, ranging in size from 12 to 4 ins., on which are set at proper intervals 45 double discharge Ludlow hydrants for which the city pays an annual rental of $65 each. There are also set at the corner of streets a sufficient number of stop valves to divide the system into small districts in case of accident and for purpose of repairs. The water supply is taken from the drive wells from 75 to 100 ft. deep near the center of the town, and so far as tested these give an ample supply of water of a most excellent quality. The system is that of direct pumping, and consists of two Walker pumping engines, each having a capacity of 1,000,000 galls. every 24 hours. These are enclosed by a handsome brick pump house built after an approved plan. The works will be completed and in successful operation about Aug. 1, 1888, the total cost of the same being about $68,000.

RECORD OF NEW WATER-WORKS CONSTRUCTION.

(Specially Communicated.)

(CONTINUED FROM PAGE 98).

Dover, Me.—The works were built in 1887; they were designed by M. M. TIDD, of Boston, Mass.; F. DANFORTH, of Gardiner, Me., was Constructing Engineer, and J. A. GOODWIN is Superintendent. The contractor was J. J. NEWMAN, of Providence, R. I. The pumping machinery was furnished by the Deane Steam Pump Co., of Holyoke, Mass.; and the pipe and specials by the Warren Foundry & Machine Co., of New York; the Chapman valves and hydrants are used. The Piscataquis river is the source of supply, and the water is pumped to a reservoir with a capacity of 750,000 galls. by a Deane steam pump of 750,000 galls. daily capacity. There are 6 miles of cast-iron pipe, and 30 hydrants. Ordinary and fire pressure, 70 lbs Debt, $60,000; rate of interest, 5 per cent. Annual revenue from city, $1,500. The franchise is for 40 years, and the hydrant rental is $50 each per annum for 30 hydrants. The works are owned by the Dover & Foxcroft Water Co.; President, WESTON LEWIS; Treasurer, JOSIAH S. MAXEY: capital stock, $160,000. The present population is 4,000. (Date of special report; May 16, 1888.)

Waterville, N. Y.—The works were commenced September 10, 1887, and were nearly completed at the date of special report, June 13, 1888; about 1 mile of distribution pipe and the lower dam remaining to be finished. They were expected to be completed in July. They were designed by W. B. RIDER, who was also Constructing Engineer. The contractor for masonry, foundations, buildings, trenching and pipe laying was W. WHITE, of Pulaski, N. Y. The pipe was furnished by the Warren Foundry & Machine Co., of Phillipsburg, N. J.; the specials by the Builders Iron Works, of Providence, R. I.; the valves by the Eddy Valve Co., of Waterford, N. Y., and the hydrants by R. D. Wood & Co., of Philadelphia, Pa. The water is taken from springs and watershed, and the supply is by gravity. There is a storage reservoir with a capacity of 22,000,000 galls., and a distributing reservoir with a capacity of 2,000,000 galls. There are 8 miles of pipe and 48 hydrants; the mains and services are of cast-iron. Cost of works, $52,000; debt, $50,000; rate of interest, 4 per cent. The works are owned by the village; stock and bonds, $50,000. The population is 1,936. (Date of special report; June 13, 1888.)

(TO BE CONTINUED).